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PRINCIPAL INVESTIGATOR: Nicole S. Bell, Sc.D., M.P.H.

CONTRACTING ORGANIZATION: Social Sectors Development Strategies, Incorporated
Boston, MA 02118

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Nicole S. Bell, Sc.D., M.P.H.

Email: nbell@ssds.net

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14. ABSTRACT
This report outlines progress made with support from grant #DAMD17-01-1-0676 "Preventing the consequences of alcohol abuse: Identification of soldiers at high risk for fatal and serious injuries" research project. The goals of this study were to improve our understanding of the risk factors for alcohol-related injury, as well as the long-term consequences of alcohol problems with regard to injuries. Another aim of this study was to obtain, develop and improve datasets and research methodologies so that they can be better used for research and prevention purposes in both the Army and civilian populations. The underlying main hypothesis of this study was that those soldiers with alcohol problems (abuse or dependence) are at greater risk of injury fatality and serious nonfatal injuries. Thus, the identification of alcohol-related problems and subsequent treatment may help reduce the risk of subsequent injuries. Individuals with alcohol-related problems could be identified from existing administrative databases, such as the hospital discharge data, health behavior surveys and alcohol treatment program data. We have described their profiles, documented increased risk for various patterns of intentional and unintentional injuries and documented the long-term sequelae of alcohol-related problems with regard to increased risk for fatal and nonfatal injuries. We have also identified protective factors and variations in the causal pathway between alcohol abuse and various injury outcomes.

15. SUBJECT TERMS
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INTRODUCTION

This report outlines progress made during grant DAMD17-01-1-0676 "**Preventing the consequences of alcohol abuse: Identification of soldiers at high risk for fatal and serious injuries**" research project. The goals of this study are to improve our understanding of the risk factors for, and long-term consequences of, alcohol problems with regard to injuries. The identification of alcohol-related problems and subsequent treatment may help reduce the risk of subsequent injuries. This study seeks to provide the data necessary to develop policies directed at reducing injuries through identification and treatment of alcohol problems. This study also seeks to develop new approaches to the analysis of currently available data sets so that they can be better used for prevention purposes in both the Army and civilian populations.

Alcohol problems, like other chronic conditions, may be identified or diagnosed under a variety of circumstances including screening during routine medical care, hospitalizations for mental health, injury or other health problems or through a variety of referral mechanisms within the Army's substance abuse and treatment program. Actual treatment of the alcohol problem following diagnoses may or may not occur and success of any treatment that does occur may be difficult to assess. As such, it is likely that soldiers with alcohol problems (abuse and dependence) are at greater risk of injury subsequent to alcohol diagnosis. There may be factors which modify risk or protect against adverse outcomes among soldiers who are diagnosed. Some soldiers may remain at elevated risk. Once identified, these patients can be targeted for prevention efforts, either to reduce or eliminate their hazardous drinking, and for injury prevention efforts that may reduce their risk of serious injury or death. This two-pronged approach is likely to lead to both reduced drinking and reduced consequences in terms of injury and lost readiness to the military.

BACKGROUND

Injuries were the fourth leading cause of death among the total U.S. population from 1999 to 2002, and the leading cause of death for 1-44 year olds (3). The largely young, male demographic composition of the military makes it an organization particularly at risk for these problems. Among active duty Army soldiers, injury is a leading cause of death and lost work days (8, 17, 20, 26). The 2002 Department of Defense (DoD) Survey of Health Related Behaviors Among Military Personnel (12) found that rates of injury hospitalizations for military personnel were approximately 500 per 10,000 population, far higher than the civilian rate of about 64 per 10,000 recently estimated by the Centers for Disease Control and Prevention (CDC) (19) and 5 times higher than the Healthy People 2000 target. Other published studies also indicate that military personnel are at increased risk for injuries as compared to age and gender matched civilians (4, 12).

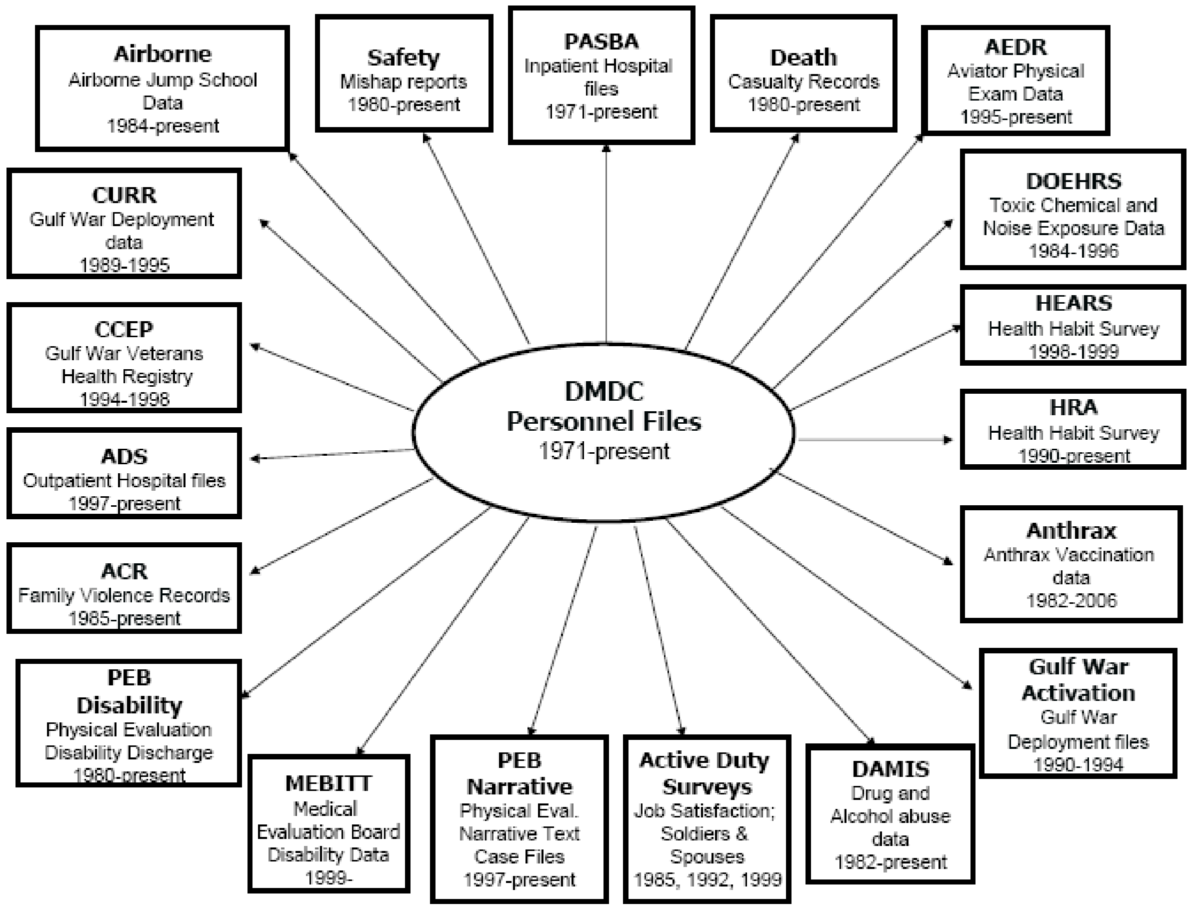
Alcohol abuse has been associated with increased risk for virtually every type of injury (9, 10, 15, 27, 28). Military populations may be particularly vulnerable to alcohol-associated injuries. Bray and others have shown that military populations are more likely to engage in high risk drinking than civilians, especially for 18-25 years olds, where prevalence of heavy drinking was about 2 times greater than similarly-aged non-military individuals (12, 16).

Understanding and quantifying the relationship between drinking behaviors and injury among military personnel is a priority for research and prevention activities. The Department of Defense (DoD) has identified injuries and alcohol abuse as two of the top three targeted areas for health promotion and preventive care research (1). It is particularly important to identify risk factors and prevention options for reducing serious injuries, such as those that result in death or hospitalization. Recent studies have examined emergency room trauma and the effects of alcohol on injury, both in the U.S. and internationally (11, 13, 14, 22). Alcohol is often a secondary condition diagnosed during treatment of trauma but it is not clear whether or not the underlying alcohol-related problem receives treatment beyond the emergency room. More data are needed to clarify how alcohol-related injuries differ from injuries that do not involve alcohol in terms of additional associated risk factors, treatment, and long-term outcomes, including risk for re-injury, additional injury hospitalizations or injury deaths. This project focuses on clarifying these relationships.

DATA SOURCES

This project draws upon data from the Total Army Injury and Health Outcomes Database (TAIHOD) (7, 8). The TAIHOD comprises data that are collected by Department of Defense (DoD) agencies for administrative purposes. It currently contains information on all Army soldiers who have been on active duty since the early 1970s - over 5 million individuals. These data sources, which are linked at the level of the individual soldier, contain information on demographic and occupational characteristics including job type, discharge from the Army and reason for separation, inpatient and outpatient health care utilization, and other health outcomes and conditions such as deaths, disabilities and treatment for alcohol or drug-related problems (see Figure 1). One key purpose of this study was to assess and improve upon the TAIHOD as a research tool for the study of alcohol-related serious injury. To this end we have devoted considerable resources to the scrupulous collection and linkage of data, the addition of new hospital records, and the review or relevant hospital file components including transfers, cause of injury coding and alcohol coding. We have examined and critically reviewed the individual datafiles and sources of information, many of which are used not only by our team but also by other research teams working in the Force Health Protection arena.

Figure 1. The Total Army Injury and Health Outcomes Database



The TAIHOD databases used for this study include personnel files, records of all inpatient hospitalizations, deaths, child and spouse abuse reports, DAMIS alcohol reports and occupational and personnel files from the DMDC. The core of the TAIHOD includes detailed personnel records containing information about demographic characteristics, occupation, deployments, and separation from military service. Approximately a quarter of Army soldiers on active duty between 1990 and the 1998 completed a Health Risk Appraisal (HRA) assessing measures of self-reported stress, distress, and risk-taking behaviors with smaller portions of the population taking HRAs after 1998. These data have been linked to the TAIHOD and are an important component of the analyses conducted under this project. Construction of variables used in testing each hypothesis occurred after careful consideration of the availability and quality of the data.

STUDIES AND RESULTS

This section of this report describes our research efforts in more detail with reference to specific Statement of Work (SOW) objectives. We also address the broader aims of our study, noting our most significant accomplishments and findings. As directed, we are including both positive and negative findings and results from these efforts. Twelve products have either been completed or are underway and nearing completion. These are described below under the specific aim that guides each effort.

EVALUATE AND IMPROVE UPON THE TAIHOD AS A RESOURCE FOR STUDYING ALCOHOL AND INJURY

We have been able to acquire and use many new datasets that have enriched our research and have helped improve upon the TAIHOD as a resource for the epidemiological study of alcohol abuse and injury.

Drug and Alcohol Management System Database (DAMIS). DAMIS data was not originally part of this study but was added when the data became available in 2003. Early in the project we developed a collegial relationship with representatives at the Army Substance Abuse Program (ASAP) who were able to facilitate our access to and use of the ASAP-related data available through the Drug and Alcohol Management Information System (DAMIS). As such, we agreed to help our ASAP colleagues in their efforts to evaluate their alcohol treatment data by linking it with our outcome measures in the TAIHOD. After obtaining necessary human use approvals and permissions to incorporate the data into the TAIHOD in September 20003, we were able to begin preparing the DAMIS data for research purposes. This database houses information on all Army soldiers referred to and/or treated within the Army ASAP as well as results from urinalysis testing resulting from random or directed drug screening. Information was provided in four separate files (1. urinalysis; 2. intake/evaluation; 3. progress reports for those enrolled for treatment; and, 4. individual-based files). Once we obtained the DAMIS files our programmer spent several weeks reviewing file formats, linking, error-checking and assessing the data.

DAMIS files are particularly useful for study of alcohol problems because the population included in the datafile is so large and the file includes information not only on referral to the ASAP program (potential alcohol problem) but also data on mechanism for referral (case finding method), diagnosis, and subsequent treatment. Where available, diagnoses are recorded in the DAMIS database according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) and also are distinguishable by an “enrollment reason” variable which denotes the type of substance abuse resulting in the referral. We have matched the DAMIS files to the Defense Manpower Data Center (DMDC) personnel files in order to examine demographic characteristics related to enrollment, treatment and re-enrollment (potentially a marker for failed treatment or severity of abuse). Three products (one completed and two nearing completion) utilize these data. These are described in greater detail below.

Pay and Compensation Files. Considerable effort has been put into updating and cleaning TAIHOD compensation (“Pay”) files. These files hold information through 2005 on both regular pay, special bonuses such as pay for exposure to hazardous duty, and military housing allowances for active duty Army soldiers. These pay files have been used to explore the association between receipt of hazardous duty pay (marker for risk exposure and risk-taking behaviors) and adverse outcomes (e.g., unintentional injury and severe domestic violence). The pay files allow us to more accurately control for differences in the socio-economic status of soldiers.

Army Discharge (Loss) Files. Our Army discharge (“Loss”) files have also been updated and are now current through 2005. These files, which contain data on discharge circumstances (reason for and type of discharge) as well as date of discharge, have been incorporated into the TAIHOD and now can be linked to all other existing databases. The accurate recording of loss data is crucial to the determination of rates (population denominators) and in assessing risk for discharge from the Army.

Army Deaths (Casualties) Files. Casualty records were updated and checked for errors and file-formatting consistency. These data were used in our analysis of risk for injury-related death subsequent to alcohol diagnosis in the DAMIS and in hospital records.

Hospital Data. Upon analyses for earlier deliverables, we encountered three unexpected challenges related to data availability and data quality. Considerable time was spent identifying the problem and seeking solutions to resolve the issues. These challenges required logistical coordination to track down missing data and significant work from our programmers to merge missing with existing data, to check for accuracy, and devise solutions to data inconsistencies. Overall progress was slowed as a result and these challenges, along with our continuing commitment to conduct analyses with complete and high quality data, prompted our decision to exercise the full year no-cost extension which was approved in June 2005. We are pleased with how we handled our data problems and with the quality of research that resulted from these efforts. Data complications included:

1. Incomplete hospitalization files. While our initial inquiries and work with the Army hospital data led us to believe records for active-duty Army were very complete, we learned that active-duty Army soldiers treated in non-Army installations (e.g., Air Force hospitals, National Guard managed field hospitals, etc.) may have been missing from some of the data files we were given from the Army hospital records system Patient Administration Systems and Biostatistics Activity (PASBA). This would also indicate that missing records are more common for soldiers who are deployed. Thus, failure to obtain this information could bias our results and limit the generalizability of our findings. We worked with our contact representative at PASBA to obtain records for active-duty Army soldiers treated in other military branch facilities. We successfully obtained this data and incorporated it into the TAIHOD. A total of 189,351 records were provided to us of which approximately 117,655 appeared to be verifiable hospitalization records for active-duty Army service members (the other records include

hospitalizations for family members, retired service members or guard/reservists). Therefore, this additional data significantly improved the quality of our research.

2. Outsourcing of care. With the advent of TRICARE in 1996 the care of active-duty military and maintenance of healthcare records changed. Some military inpatient treatment facilities closed and it became more common to outsource active duty military patients to non-military facilities. While this trend was observed for all types of conditions, outsourcing of care may have been particularly likely for conditions such as substance abuse. Treatment records, for care received outside the military, are maintained in Army Health Care Service Record (HCSR) hospital files. However, these data are not uniformly available through the PASBA inpatient hospitalization files that we have in our TAIHOD database. Analyses that do not include these missing data will be of limited value for more recent years since inpatient admission rates in the PASBA data begin to drop off rapidly after 1996. Again, we had to work with our contacts with PASBA along with several administrative agencies in order to obtain this missing data. Furthermore, human privacy rules and regulations have evolved over the past few years especially within Department of Defense agencies. As a result, our ability to obtain the necessary data in an expeditious manner was compromised. Our programmers needed to ensure that they had high-level secret government clearance and steps were taken to assure the granting agencies that all human subject protection provisions were in place from both a research and a logistical, technological perspective. Once we had access to and permission to use this data, we were able to incorporate it into our analyses.

3. Identification of unique episodes of hospital care as distinct from hospital transfers to continue care. Our specific aims include a careful assessment of the incidence and prevalence of alcohol- and injury-related hospitalization rates. In order to avoid over-counting hospitalizations for individuals who are transferred to continue care for a single incident we worked on developing an algorithm that incorporates transfer in and transfer out data, facility codes and diagnoses (all available in the PASBA hospital files). However, we had encountered a number of soldiers who appear to have multiple hospitalizations within a short period of time, but whose transfer in/out data are either incomplete or are missing altogether. Our PASBA contact has suggested that some of this information might be obtained through review of treatment records for care received outside Army facilities. The missing data referred to above under items 1 and 2 was necessary to improve our ability to count hospitalizations, as many transfer hospitalizations were not accounted for in our existing data, but rather are available through these additional PASBA and TRICARE files. Careful determination of these episodes of care was necessary for almost all of our promised deliverables.

The process of understanding the relationship between initial hospitalizations and any related transfer hospitalizations was very complex, albeit crucial for the integrity of our scientific methodology. We were able to use additional, existing TAIHOD components to fully grasp the nature of transfer events and to fully understand the best way to count a string of multiple, related hospitalizations as a single event, or episode of care. When available, narrative text files of hospitalizations were useful in determining circumstances under which a soldier would be transferred for continuation of care as

were the presence of codes indicating cause of injury. Through careful review of our hospitalization data and through discussions with our PASBA representatives we were able to select certain variables that would be useful in determining transfer hospitalizations for continuation of care. When a patient is transferred from one facility to another for continuation of care, administrative records are supposed to contain "transfer in" and "transfer out" codes for all components of the episode of care. Additionally, when these transfer codes are present, they should also include a code denoting the Military Treatment Facilities involved in the initial and transfer hospitalizations. While, due to administrative burdens and mistakes, neither the transfer codes nor the military treatment facility (MTF) codes are captured 100% of the time, we believe that we are able to more accurately distinguish between discrete events and multiple hospitalizations that comprise a single episode of care.

These data discoveries and accounting for transfer hospitalizations offer an advantage for our research over similar work with administrative hospitalization databases. Without viewing a string of related hospitalizations as one event, individual hospital records inaccurately represent disease counts rather than actual episodes of care, thus inflating disease estimates. Moreover, changes in rates over time cannot be accurately evaluated without some information about readmission and transfer rates. Such variations may represent a true increase or decrease in cases or simply a shift in the number of patients with more than one consecutive admission for the same condition (18). Also, over-estimates of hospitalized cases can result in underestimates of case-fatality rates by inflating the denominator (the number of individuals with a disease) (25, 29). The resulting efforts to account for these episodes-of-care have proven to be invaluable for all projects that use hospitalization data from the TAIHOD and will continue to have a lasting impact on the quality and integrity of TAIHOD-related research into the future.

A Technical Report **(Paper 1)** at USARIEM titled, "The Total Army Injury and Health Outcomes Database (TAIHOD): uses and limitations as a research tool for force health protection research," relied upon information learned about inpatient and outpatient hospitalization data, DAMIS data, pay data and discharge data. Therefore this report was in large part informed by this grant. A copy of this report is provided in Appendix A. Findings related to measuring episodes of care were presented at the Department of Defense, Peer Reviewed Medical Research Program (PRMRP) Investigators Meeting in Puerto Rico in April 2004. An abstract from this presentation is provided in Appendix B.

<u>SPECIFIC AIM 1</u>. TO DETERMINE THE PREVALENCE OF ALCOHOL-RELATED DIAGNOSES AMONG ACTIVE-DUTY SOLDIERS DISCHARGED FROM HOSPITAL USING ALCOHOL DIAGNOSES RECORDED IN HOSPITAL DISCHARGE DATABASES.

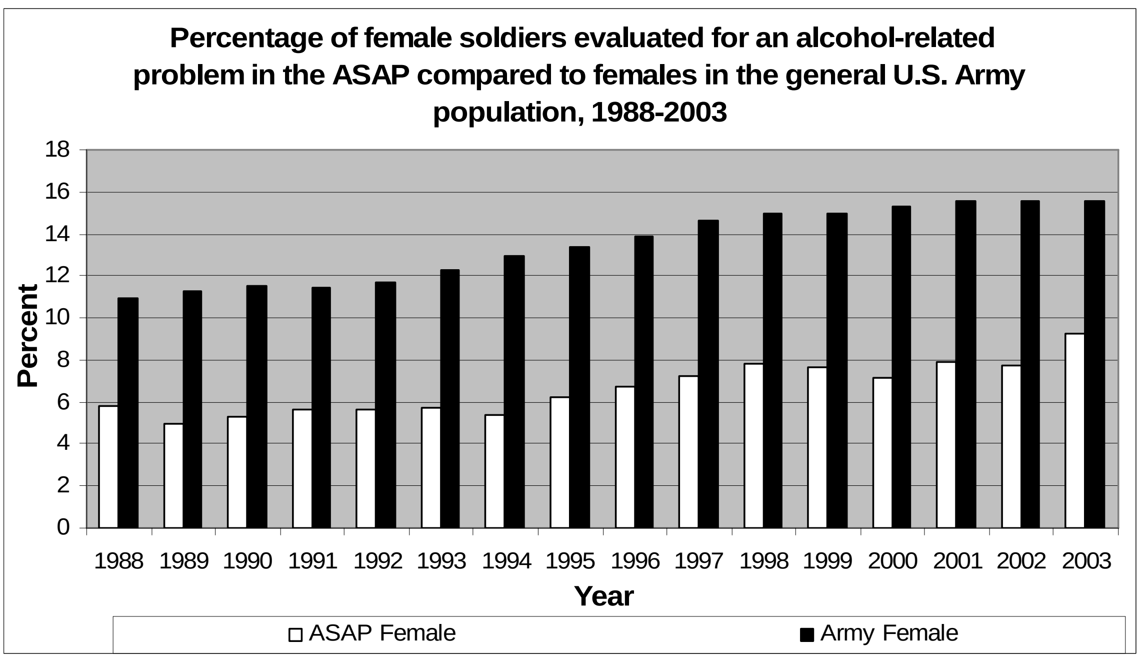
Under this first objective we completed 3 products and are finishing 1 other. Our first product (**<u>Paper 2</u>**), "A historical look at alcohol abuse trends in Army and civilian populations, 1980-1995," is currently under review at *Military Medicine*. This paper reports the prevalence of alcohol-related hospitalizations and compares them to age-, gender- and race-adjusted civilian rates. Relevant alcohol-related policies and legislation were plotted against these rates to assess possible effects of these policies. Because specific types of alcohol-related disorders may respond differently to policies (e.g., alcohol dependence may be less tractable than occasionally heavy drinking episodes), we also explored the impact of policy and regulation on different types of drinking patterns. We found that overall alcohol hospitalization rates were similar in civilian and Army populations. Combination drug and alcohol abuse (polyabuse) rates were higher among civilians (16.6 per 10,000) than Army soldiers (5.1 per 10,000). Overall civilian and Army alcohol hospitalizations appear unaffected by legal controls, but nondependent alcohol disorders appeared responsive to regulation; in the Army, rates fell 69% between 1985 and 1995. Our research concluded that dependent alcohol abuse appears less responsive to legislation than nondependent alcohol abuse. Military pre-enlistment screening, aggressive drug testing and zero tolerance policy may explain lower polyabuse rates. Without longitudinal, diagnosis-specific subgroup analysis these trends would not have emerged. These analyses also relate in part to objectives under SOW 2 where we aim to compare Army alcohol rates to civilian. A copy of this manuscript under review is attached in Appendix A.

Our second product related to this objective (**<u>Paper 3</u>**) is an Army Technical Report, "A Descriptive Study of U.S. Army Soldiers Referred to, Evaluated by, and Enrolled in the Army Substance Abuse Program, 1988-2003." This describes the demographic and occupational characteristics of Soldiers referred to ASAP for an alcohol abuse evaluation by linking ASAP data to Army personnel data. Details regarding ASAP referral mechanism (i.e. medical referrals, referral following a legal investigation, self referrals) are explored. In some cases Soldiers referred to ASAP are not enrolled for treatment; these special cases are investigated. We found that Soldiers who were single, young, male, of lower rank, of lower education, in the infantry and not black are overrepresented among alcohol referrals. Additionally, different referral processes seem to reach different demographic subgroups of the population. Males were much more likely than females to be referred for evaluation as a result of an investigation, and were also more likely to be referred as a result of drinking under the influence (DUI). Female Soldiers were more likely to self-refer, to have a medical referral, or be referred by family. Hispanics and no-longer-married Soldiers were both more likely than others to be referred to ASAP for evaluation following a DUI charge. High re-enrollment rates among the self-referred can be used to reassess the ASAP counselor or Commander's approach to treating self-referring Soldiers. Similarly, soldiers sent to prevention training in lieu of enrollment have high rates of re-evaluation.

This study also assessed important differences between alcohol abuse among males and females which relates to Statement of Work Task 6. We noticed variations in repeat referrals over time with less referrals recorded during the end of our study period. These variations might be explained by actual changes in recidivism, changes in overall

rates of problems due to changes in the demographic composition of the Army population over time, changes in detection of alcohol-related problems, changes in likelihood of referral given identification of a problem, or by the fact that there is less opportunity to have a repeat event in the second period because of shorter follow-up time. It was not possible with these data to test all of these hypotheses. However, additional analyses were conducted in order to assess the effects of changes in the gender composition of the Army. TAIHOD data reveal that there have been important shifts over time in the demographic composition of the Army with the proportion of female enlisted Soldiers rising approximately 43%, from 10.9% to 15.6%, over the study period from 1988 to 2003. Because women tend, on average, to engage less frequently in certain high-risk drinking practices, it is possible that lower recidivism rates are explained, in part, by greater representation of women in the Army in more recent years. However, the data did not support this hypothesis. While the proportion of persons referred to ASAP who are women increased over the study period (58% increase from 5.8% to 9.2%) (Figure 2), this increase is larger than the actual increase in the proportion of women in the total population. This suggests that the gender difference in risk of alcohol referral is getting larger even after accounting for the growing number of females in the general Army population.

Figure 2. Percentage of female Soldiers evaluated for an alcohol-related problem in the ASAP compared to females in the general U.S. Army population, 1988-2003



Aspects of this Technical Report were presented at the annual American meeting of the American Public Health Association in November of 2006, and are also being transformed into an article which will be submitted to journal in the near future. A copy of the Technical Report is provided in Appendix A and a copy of the conference abstract is provided in Appendix B.

Related to our efforts to improve knowledge-based policy decision making we also produced a document, "Spouse Abuse is an Important Public Health Problem Facing the Military" for the Uniformed Services University of the Health Sciences (**Paper 4**). This document was used as the basis for a teaching article in the Department of Psychiatry's quarterly publication, *Joining Forces*. The link between alcohol misuse and spouse abuse, including theories and the science behind this association as well as the influence of study design in assessment of spouse abuse and drinking were detailed in this article. A copy of this summary article is attached in Appendix A.

In addition to these completed projects, we are finishing work on a fourth product, "Risk for relapse, injury and other adverse outcomes among Army soldiers who have completed alcohol treatment between September 1988 and August 2003" (**Paper 5**).

All active duty Army soldiers between September 1, 1988[1] and August 31, 2003 may be potentially selected for study as either exposed (treated through the Army's substance abuse treatment program (DAMIS treatment) or unexposed (never in DAMIS files) and followed over time. Once a soldier is referred to the Army Substance Abuse Program for evaluation, a rehabilitation team determines that soldier's enrollment status. Treatment can entail a mandatory, short-term educational prevention program, outpatient counseling or inpatient treatment. Soldiers are only enrolled if there a likely possibility for recovery and return-to-duty after treatment.

Measures: Exposed (3 Alcohol Treatment Groups)

We have identified three different treatment (exposure) groups based upon the severity of the condition and related treatment received. All treatment group cases must have at least one record in the DAMIS files indicating they were referred to DAMIS for alcohol. That is, they must have a referral intake form for alcohol during the study period (PIR_enroll = 1—reason for referral = alcohol). Where the subject has more than one alcohol referral we will use the first one as the initial case event and begin follow-up after that event. Anyone with a referral to the DAMIS program to assess them for alcohol problems, between Sept 1, 1988 and August 31, 2003 will be an "exposed case".

Once sent for an evaluation soldiers might be enrolled and sent to intensive inpatient treatment, enrolled and sent to outpatient therapy or not enrolled. Initially, we intended to only follow soldiers who were evaluated for a potential alcohol problem and ultimately enrolled. But, a thorough investigation into the history and process of DAMIS treatment suggested that those who were evaluated but not enrolled often did receive alternate, usually less involved, forms of treatment (ADAPT program) that we would like

[1] The September 1988 start date was chosen because this is the first time a non-enrollment reason variable was used by the Army. Prior to this time, DAMIS only has data on soldiers who were referred to and enrolled in ASAP. Some soldiers were referred to the DAMIS program but not enrolled for a variety of reasons including the determination that they did not have a problem or because they were enrolled in a different program. The information on their disposition is important to our goal of categorizing treatment and following treated soldiers over time.

to study. Thus, individuals who were referred and enrolled as well as individuals who were referred and not enrolled but who went through “ADAPT” are eligible to be cases. Our 3 treatment groups are: not-enrolled but sent to ADAPT, enrolled outpatient treatment only, and enrolled inpatient treatment.

In order to be able to fully assess risk factors and demographic factors, cases must also have TAIHOD personal files that match +/- 6 months from the referral date. To ensure adequate follow-up we also decided to retain only cases who we believe successfully completed their programs in a standard amount of time. Based on review of DAMIS treatment protocol and distribution of data we determined that those in the non-enrolled ADAPT group had to remain on active duty for 37 days after their initial referral to alcohol treatment date (30 days treatment[2] plus up to 7 days to account for lag time between case identification and DAMIS intake apt.). For the enrolled, we kept only those cases who had a final progress report = return to active duty (eliminating those cases where time between initial referral and final progress report is negative or 0 days).

There were a few inexplicable extreme cases where soldiers appeared to be in treatment for more than a year. For enrolled in outpatient care, we removed cases with more than 372 days (one year plus a week for processing) between initial referral and enrollment end date[3]. For the inpatient treatment group, we eliminated those with more than 555 days time between initial referral and final progress report (18 months plus 7 days lag time). Note: early exploratory analysis reveals that 18 months of follow-up keeps 93% of the inpatient population with final progress report of return to duty. 95% of the outpatient treatment group has completed their treatment program by 1 year (365 days).

Unexposed (Non-alcohol comparison group)

Once all cases were selected and randomly sorted by date so there is no temporal order and no order with regard to case type (enrolled or nonenrolled status, etc.) we selected controls for each case in 3:1 ratio to the cases. Controls were kept with the cases for which they have been because the criteria for selection differs by treatment group in terms of how long they have to remain on active duty. Controls had to meet the same criteria as cases. Criteria for controls: (1) Control can never be in the

[2] 30 days of treatment is based on information from Tom Marquez (DAMIS contact) who said that ADAPT treatment involves 12 hours of classes that must be completed within 30 days.

[3] The rational for dropping those with excessively long treatment periods is (1) treatment is supposed to be of short duration (outpatient treatment is generally 90-365 days, with progress reports every 90 days). Longer duration may imply they have trouble complying with the treatment program (not successfully treated); (2) could also suggest we have some problems with errors in data, etc. but there is no way to check. Since in patient treatment is supposed to be 6 weeks followed by some outpatient treatment and a year of follow-up 18 months seems reasonable time to consider.

DAMIS files (for alcohol or drugs[4,5]), (2) must be on active duty at same time as the case alcohol referral date and must in particular have DMDC record in same file period (6 month file) as the case. (3) Controls must also remain on active duty for the same specified period as their matching case. For example, for ADAPT alcohol treatment group controls must remain on active duty for 37 days after the initial treatment referral date. They cannot have a discharge from the Army during this follow-up time. For the enrolled population, the controls must remain on active duty for at least 555 days after initial referral date for the case, etc.

<u>Key Covariates, Effect Modifiers and Controls:</u>
Demographic characteristics: age group (<21, 21-25, 26-30, 31-35, 36-40, >40), educational attainment (less than high school, high school/GED or equivalent, some college or associates degree, bachelor degree, > BA/BS (some graduate training beyond BA/BS), Race/ethnicity (white, black, Hispanic, Asian/Pac Islander, Indian/Alaskan native, other), rank (junior enlisted E1-E4, midlevel enlisted E5 & E6, senior enlisted E7 – E9, warrant, junior officers O1-O3, midlevel officer O4 & O5, senior officer O6-O11), marital status (single, married, divorced/widowed/separated), era or date (year) of event, DAMIS factors including referral mechanism, number of evaluations, dates, disposition.

<u>Outcome Measures</u>

Several outcomes will be measured in each phase of the study. During phase 1 we will look for 1 or more events of each type (defined below) occurring within the defined “treatment” period. During phase 2 we will follow subjects and matched “control” (unexposed) over time in time-to-event models to assess risk for hospitalization after treatment and up until December 2004 or subject leaves the Army (censored).

<u>Hospitalization:</u> During the first phase, we will look at risk for one or more hospitalizations during the treatment period (defined as 37 days for the not-enrolled ADAPT group, up to 372 days for the enrolled outpatient and 555 days for the enrolled inpatient treatment group). PASBA file will be searched for any record during the follow-up period. The first hospitalization record will be evaluated for primary and secondary diagnoses of interest (see below) as well as a yes/no flag for hospitalization of any type.

For each treatment group (and their controls) the hospitalization follow up assessment proceeded in a different manner. For not enrolled ADAPT treatment group

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[4] Though we are focused on alcohol, the likelihood that drug abuse is a flag for other substances abused, including alcohol, would make drug abusers less than ideal as controls. Thus, drug abuse referrals to DAMIS are not eligible to be controls even if they do not have an alcohol referral to DAMIS.

[5] Technically, what we are saying is that they can never be in the PIR or PPR files within the DAMIS database. The DAMIS database also includes DA3711 forms produced for random drug testing. Presumably, all soldiers may have a DA3711 file without actually having a drug or alcohol abuse history. Thus, controls might have a DA3711 file because of random screening but they may not have a PIR or PPR file for alcohol or drug abuse referral, evaluation or treatment.

we began follow up after 37 day time period. For the enrolled outpatient only group, we followed cases and assigned controls up to 372 days from initial referral date. For enrolled inpatient we started follow-up when they were discharged from the hospital for their alcohol treatment and began their follow-up care up until 555 days from initial referral.

Injury Hospitalization: ICD diagnosis in any position of an 800 –995—***EXCLUDING 980.0*** (Ethyl Alcohol Poisoning) but including other subordinate codes (subcategories of 980) including 980.1, 980.2, 980.3 and 980.4. Also Note: This definition excludes only ethyl alcohol poisoning but includes 960-980 Poisoning by other drugs, medicinal and biological substances. As is commonly done, we are excluding 996-999 (injury due to medical mishaps and the like).

Alcohol Hospitalization: ICD diagnosis in any position of any of the following alcohol codes (see below). In addition to an overall alcohol code we created flags for each specific type of alcohol-related hospitalization (polyabuse, alcohol psychosis, alcohol dependence syndrome, etc.).

We have completed the study population selection step and are now beginning analysis to address research questions. Because of the size of the dataset and the complexity of the analytic design, selection of the cases and controls has taken longer than expected. We expect the next phase of analysis to proceed more quickly. Preliminary findings on the study population are presented below in Table 1.

Of the 92,316 alcohol treatment cases, the majority (55.7%) were treated through the brief educational program (ADAPT), followed by 39.6% treated in an outpatient setting and 4.8% treated through an inpatient treatment program. Demographic characteristics were associated with type of treatment. Factors associated with inpatient treatment, as opposed to the other treatment groups, included female gender, older age, white or black race, some college education or greater, higher rank, and being married or formerly married (widowed or divorced).

TABLE 1: DEMOGRAHPIC CHARACTERISTICS OF SOLDIERS REFERRED TO THE DAMIS PROGRAM TO ASSESS THEM FOR ALCOHOL PROBLEMS, BETWEEN SEPT 1, 1988 AND AUGUST 31, 2003, AND ULTIMATELY TREATED FOR THE ALCOHOL PROBLEM, BY TYPE OF TREATMENT OFFERED (N = 92,316)

	Group A ADAPT only N = 51,377	**Group B Outpatient** N = 36,539	**Group C Inpatient** N =4,400
	N (column %)	N (column %)	N (column %)
Gender			
Men (N=87109)	48417 (94.2)	34697 (95.0)	3995 (90.8)
Women (N=5207)	2960 (5.8)	1842 (5.0)	405 (9.2)
Age			

<21 (N=22476)	13980 (27.2)	8133 (22.3)	363 (8.3)
21-25 (N=41108)	23674 (46.1)	16243 (44.5)	1191 (27.1)
26-30 (N=15347)	7952 (15.5)	6455 (17.7)	940 (21.4)
31-35 (N=7844)	3587 (7.0)	3349 (9.2)	908 (20.6)
36-40 (N=4133)	1655 (3.2)	1786 (4.9)	692 (15.7)
>40 (N=1341)	493 (1.0)	546 (1.5)	302 (6.9)
Unknown (N=67)	36 (0.1)	27 (0.1)	4 (0.1)
Race/Ethnicity			
White (N=58970)	31750 (61.8)	24176 (66.2)	3044 (69.2)
Black (N=22856)	13251 (25.8)	8664 (23.7)	941 (31.4)
Hispanic (N=5090)	3122 (6.1)	1793 (4.9)	175 (4.0)
Asian/Pac Islander (N=338)	847 (1.7)	444 (1.2)	47 (1.1)
Indian/Alaskan (N=108)	519 (1.0)	506 (1.4)	83 (1.9)
Other (N=2200)	1156 (2.3)	934 (2.6)	110 (2.5)
Unknown (N=754)	732 (1.4)	22 (0.1)	0 (0.0)
Education			
LT Highschool (N = 2070)	1289 (2.5)	732 (2.0)	49 (1.1)
Highschool/or Equiv. (N=85124)	47134 (91.7)	34186 (93.6)	3804 (86.5)
Some college (AA) (N = 1,848)	912 (1.8)	708 (1.9)	228 (5.2)
College degree (BA/BS) (N=2140)	1337 (2.6)	587 (1.6)	216 (4.9)
> college (MA or PhD) (N =276)	94 (0.2)	109 (0.3)	73 (1.7)
Other/Unknown (N = 858)	611 (1.2)	217 (0.6)	30 (0.7)
Rank			
E1-E4 (N=68585)	39739 (77.4)	26937 (73.7)	1909 (43.4)
E5-E6 (N=18379)	9106 (17.7)	77237 (21.1)	1549 (35.2)
E7-E9 (N=3658)	1505 (2.9)	1442 (4.0)	711 (16.2)
Warrant (N=326)	167 (0.3)	109 (0.3)	50 (1.1)
O1-O3 (N=1113)	784 (1.5)	236 (0.7)	93 (2.1)
O4-O5 (N=227)	74 (0.1)	79 (0.2)	74 (1.7)
O6-O11 (N=27)	2 (0.0)	11 (0.0)	14 (0.3)
Marital Status			
Single (N=54236)	32221 (62.7)	20538 (56.2)	1477 (33.6)
Married (N=34023)	17186 (33.5)	14314 (39.2)	2523 (57.3)
Divorced/Wid/sep (N = 3053)	1466 (2.9)	1264 (3.5)	323 (7.3)

<u>SPECIFIC AIM2</u>. TO DETERMINE, AT INJURY DISCHARGE FROM HOSPITAL, THE PREVALENCE OF ALCOHOL-RELATED COMORBITY.

As noted above, **<u>Paper 2</u>** addresses some of the tasks related to AIM 2. Also, as reported in the beginning of the results section, a major objective under Aim 2 was to utilize extensive data available for assessing transfer records which allows for more accurate recording of unique events. This is generally not possible with most civilian injury hospitalization databases and a major strength of the studies under this grant.

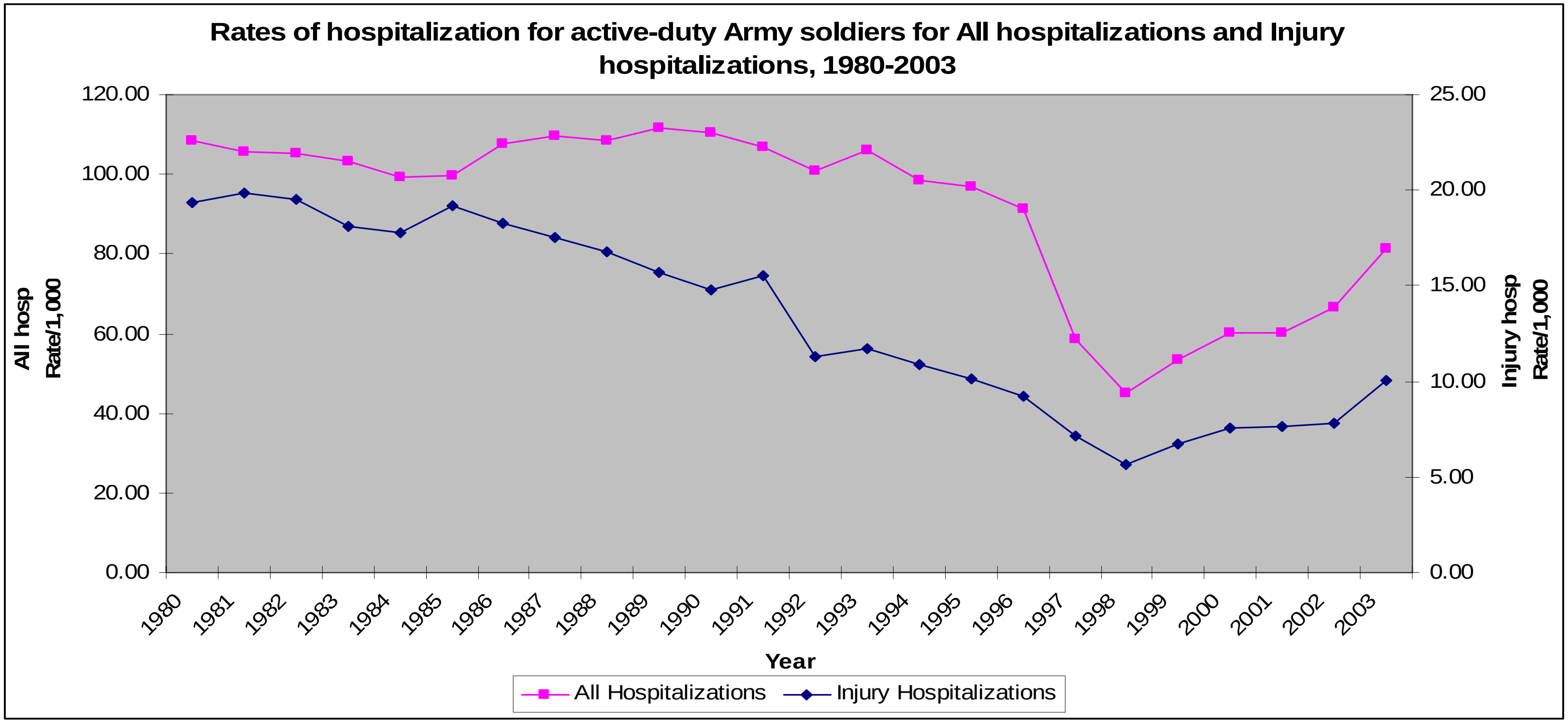
We are also completing analyses on “Trends in injury hospitalization with and without secondary alcohol abuse: the influence of intent” (**Paper 6**). This paper describes the long range trends in Army injury-related hospitalization rates with and without alcohol comorbidity, documenting how the relative proportion of injury hospitalizations with an alcohol comorbid diagnosis has changed over time. Because Army hospital data, unlike civilian data, include very complete cause of injury coding (5, 6), including intentionality, we will also explore long-term trends in rates for intentional and unintentional injury hospitalization as well as concomitant alcohol diagnosis. We also explore specific causes of intentional injury over time and look at changes in relative rates of suicide/self-inflicted, versus assault and the relative proportion of events that involve alcohol as a secondary diagnosis.

Between January 1, 1980 – December 31, 2003) there were 269,312 hospitalization records (231,590 individuals). After identifying injury hospitalizations we matched to the master personnel file requiring that a record within a year of the injury event be available in the file. 94.8% of the file had matching DMDC (personnel) records. The remaining 5.2% (n = 14,128) were dropped leaving 255,184 hospitalization records (out of the original 269,312 initially identified). Over the entire study period there were 220,506 individuals who experienced one or more injury hospitalizations.

Of the 255,184 injury records, the vast majority of individuals (87%) had only one injury hospitalization record and 11% experienced only two injury hospitalizations (10.8%); just under 2% (1.7%) had only three records and there were a few with more than three records. Some of these multiple injury records represent repeat injuries and some reflect hospital records that were created when an individual is transferred to continue care in another medical facility. Thus, these transfer records do not constitute unique events. Through our algorithm we identified 11,189 (4.4% of injury records) as probable transfers and we also located 2417 duplicate records. When these were removed this reduced the initial 243,995 hospitalization records 255,184 unique injury hospitalization events by 220,506 individuals. The vast majority of individuals (87%, n = 191,823)) experienced only one hospitalization during the study period. 10.9% (N = 23,992) experienced two hospitalizations and 1.7% (n = 3,732) experienced three hospitalizations and a few individuals experienced more than 3.

Early analyses suggest that, as expected, overall hospitalizations have declined over the study period. The relative proportion of injury hospitalizations declined at a faster rate until about 1998 at which time the relative proportion of injury-related hospitalizations increased slightly. Both injury and overall hospitalization rates appear to have risen slightly since 1998. See Figure 3 below.

Figure 3.

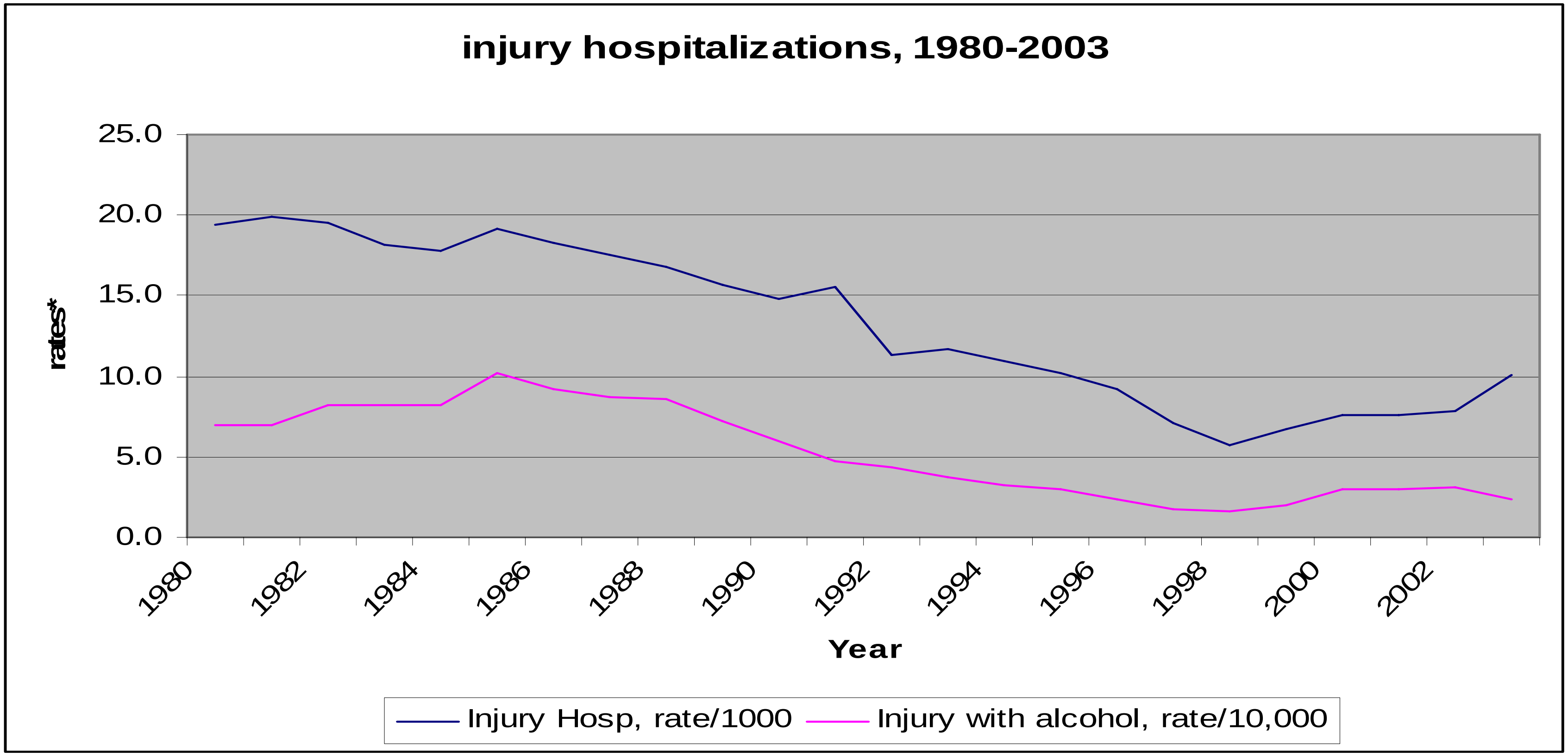


We also identified injury cases that had an associated alcohol diagnoses either in the secondary diagnostic position with the injury record OR in a follow-up hospital record after patient was transferred to another facility to complete their care. Four percent of the hospitalizations with a primary diagnosis of injury had a secondary alcohol-related diagnosis. Most (3.9%) of the comorbid alcohol diagnoses were identified within the same treatment record as the injury event (N = 9456). But, an additional 266 alcohol diagnoses were identified by review of records from other treatment facilities involved with care of the injured soldier after the initial injury event. The majority of secondary alcohol diagnoses were alcohol abuse unspecified (305.00) which comprised 41% of the total group of secondary alcohol diagnoses associated with injury hospitalizations. This was followed by nondependent abuse of alcohol (305.40) which comprised 31% of the total alcohol-related secondary diagnoses. Other subcodes within the 305 major diagnostic group were also common. 77% of all the alcohol diagnoses were either 305.00, 305.01, 305.02, or 305.40. An additional 11% were either 303.00 or 303.01 (acute alcohol intoxication unspecified or acute alcohol intoxication continuous) and 5% were coded 9800 (toxic

effects of ethyl alcohol). The remaining 7% were distributed throughout the other codes. The proportion of injury hospitalizations with a secondary alcohol diagnosis declined over the study period until 1994. They have remained largely stable since that point (See Figure 4 below).

Analyses are not yet completed on this study but will include an assessment of trends in intentional injury hospitalizations in more depth, both those with and without an alcohol secondary diagnosis as well as patterns of alcohol comorbidity associated with selected specific types of injury including motor vehicle crash related injury and self-inflicted injury. A major strength of this study is the ability to account for transfers, to include intent and to follow subjects for a relatively long period of time and to assess patterns in alcohol-comorbidity.

Figure 4.



* Rates for injury hospitalizations overall expressed in cases/1,000. Rates of injury with alcohol hospitalizations expressed in cases/10,000.

<u>SPECIFIC AIM 3</u>. TO DETERMINE IF THOSE CASES WITH AN INJURY AND ALCOHOL DIAGNOSIS DIFFER BY CIRCUMSTANCES OF INJURY (E.G., UNINTENTIONAL MOTOR VEHICLE CRASHES, ASSAULT) FROM THOSE WITH AN INJURY DIAGNOSIS BUT NO ALCOHOL DIAGNOSIS.

Under Aim 3 we have completed **<u>Paper 7</u>**: "Causes and nature of injury among army soldiers hospitalized with alcohol comorbidity" which is currently under revision pursuant to reviewer comments from the journal *Addiction*. This paper examines the relationship between alcohol use and risk for specific types and causes of injury. Using the TAIHOD we selected active duty US Army soldiers (N=211,790) hospitalized with a primary diagnosis of injury between 1980 and 2002 to conduct cross-sectional analyses of the association between alcohol comorbidity and the nature, cause, and severity of injury. We found that alcohol comorbidity was positively associated with head injury, open wounds and poisonings and negatively associated with musculoskeletal injury; positively associated with fights and falls and negatively associated with sports injury; and, on average, associated with shorter length of stay. Controlling for demographic factors did not moderate the association between alcohol and nature, cause or severity of injury. Overall, we concluded that injury nature, cause and severity covary with alcohol comorbidity. Specifically, our findings indicate that injured hospitalized U.S. Army soldiers with alcohol comorbidity differed from their injured peers without alcohol comorbidity in their demographic characteristics, the types and causes of injury, and average LOS to treat their injuries. Alcohol comorbidity was associated with head injury, poisonings, and open wounds, whereas the absence of alcohol comorbidity was associated with lower extremity musculoskeletal injury. Alcohol comorbidity was associated with falls and fights, whereas the absence of comorbidity was associated with sports-related injuries. Average LOS was shorter for those with alcohol comorbidity, with the exception of those being treated for lower-extremity musculoskeletal injuries, which were often sports-related. Alcohol was also associated with falls, fights, and motorcycle, bicycle, and car crashes, all common causes of head injury. The association between alcohol comorbidity and head injury could have been an artifact of clinical protocols (e.g., toxicology screening when neurological damage is evident or suspected), but, is consistent with findings by other investigators. A copy of this paper is attached in Appendix A.

We have also completed **<u>Paper 8</u>**: "Alcohol abuse history, health behaviors and psychosocial risk factors for assault-related hospitalizations among active duty Army soldiers" which is currently under review at *Annals of Emergency Medicine*. It explores risk factors for serious assault-related injuries and the relationship between alcohol and assault-related injuries. The overall objective was to assess the association between drinking and other health and social behaviors and risk for assault-related hospitalization by using a cohort study comprised of 423,861 active-duty Army soldiers who completed a Health Risk Appraisal Survey (HRA). These soldiers were followed through December 31, 2002 to see if they experienced an assault-related hospitalization. Our results yielded 807 soldiers were hospitalized at least once for assault during the follow-up period. In multivariable Cox proportional hazards models male gender (3.45, 2.19-5.43), age under 31 (3.98, 2.71-5.85), black race versus white

(1.65, 1.35-2.01), single marital status (1.69, 1.38-2.07), drinking 7 or more drinks per week versus abstaining (7-14 drinks =1.87, 1.42-2.47, >14 drinks = 1.68, 1.18-2.39), driving or riding in the past month with someone who had been drinking (1.39, 1.10-1.75), current smoking versus never (1.26, 1.03-1.54), and wearing a safetybelt less than 100% of the time (51-99% = 1.43, 1.16-1.76, 0-50% = 1.92, 1.52-2.43) were significantly associated with risk for assault. While all measures of alcohol abuse were predictive of subsequent risk for assault in the unadjusted analysis, once we had taken into account gender, race, age, education, rank and other demographic factors, only heavy drinking (weekly alcohol consumption) and drinking and driving exposure in the past month were significant predictors of subsequent alcohol hospitalization. Alcohol dependence (as measured by an extended version of the CAGE) appeared protective (though the Hazards Ratio did not achieve statistical significance). There was a consistent, though nonsignificant trend of increasing risk for assault among women who report greater levels of job dissatisfaction and worries about their lives. This trend was not observed for men. It may be that these behaviors and psychosocial factors are more closely related to self-esteem among women than they are among men. Heavy weekly drinking was the only variable significantly associated with hospitalization assaults where there was also a secondary diagnosis of alcohol abuse. Though heavy drinking is a risk factor for assault, especially alcohol-involved assaults, it should be pointed out that the majority of assault hospitalization cases did not include a secondary diagnosis of alcohol, even when the soldier reported typical heavy drinking levels on HRA surveys taken prior to and independent of the assault hospitalization. A copy of this manuscript is provided in Appendix A.

<u>SPECIFIC AIMS 4 AND 5</u>. TO DETERMINE TO WHAT DEGREE AN ALCOHOL-RELATED DIAGNOSIS INCREASES THE RISK FOR REPEAT SERIOUS INJURY (DEATH, AND INPATIENT HOSPITALIZATIONS) COMPARED TO ARMY PATIENTS WITHOUT ALCOHOL DIAGNOSES. TO DETERMINE IF PERSONS DISCHARGED WITH BOTH AN INJURY AND ALCOHOL DIAGNOSIS ARE AT AN ELEVATED RISK OF A REPEAT SERIOUS INJURY (DEATH, AND INPATIENT HOSPITALIZATIONS) RELATIVE TO THOSE WITH AN INJURY DIAGNOSIS BUT NO ALCOHOL DIAGNOSIS.

Aims 4 and 5 overlap some so findings are reported simultaneously. **<u>Papers 9 and 10</u>** as well as **<u>Paper 8</u>** (described above) all address the role of alcohol-related hospitalizations and risk for subsequent repeat injury or other adverse event such as suicide.

<u>Paper 9,</u> "Alcohol abuse and Alcoholism, Mental Health Disorder, and Injury Hospitalization History and other Risk Factors for Completed Suicide: A Case-Control Study of 7,492 enlisted Army Soldiers," is being revised pursuant to comments and recommendations by reviewers from the journal *Addiction*. This paper examines the associations between alcohol consumption patterns, alcohol dependence as well as other mental health disorders, prior injury hospitalization (intentional and unintentional), and other background variables and risk for completed suicide among US Army

soldiers. We compared 1,873 soldiers with completed suicides between January 1, 1980 and December 31, 2003 to 5,619 randomized, matched controls. In multivariate models, increasing age, male gender, white race, single marital status and enlisted (versus officer) rank were all associated with suicide. In addition, prior injury (OR = 1.96, 95% CI = 1.59-2.43), alcohol (OR =3.37, 95% CI = 2.30-4.94), and mental health hospitalizations (OR = 6.63, 95% CI = 4.77-9.20) were all associated with suicide. Risk for suicide was greatest immediately after diagnoses was made, particularly for alcohol and other mental health disorders, but remained significantly elevated even after five years or more of follow-up. Most injury hospitalizations were unintentional but were, nonetheless, associated with increased risk for subsequent suicide, particularly when the cause of injury was guns or poisoning, but also for machinery and fall-related injuries. We found that soldiers with mental health disorders are discharged from the Army earlier than those with other health problems. Given the strong association between mental health disorders and suicide, longer follow-up of these soldiers is warranted, particularly given the alarming increases in suicides over the past decade. A copy of this manuscript under review is attached in Appendix A.

Paper 10, "Gender differences in risk factors for victims of spouse abuse: Behavioral, psychosocial, and demographic patterns," identifies risk factors for spouse abuse victimization and explores gender differences in these factors. In this case-control study, we compared active-duty enlisted Army soldiers who were spouse abuse victims between 1989 and 2002 to controls matched on marital status and military rank. We found that victims were younger, less educated, non-Caucasian, lower-ranked, and spent fewer years in service than controls. Having a record of spouse abuse perpetration was associated with a very large increase in risk for being a victim in a subsequent spouse abuse event (OR = 26.8 for women, 67.6 for men), particularly if the spouse abuse event was less than 90 days or less prior to the victimization event (OR = 8.3 for women, 17.6 for men). For males, history of problem drinking and imbibing more than 15 drinks per week increased victimization risk (OR = 1.24). Our hierarchical multiple logistic regression models revealed that: (1) alcohol abuse is a risk factor for victimization among men only, and its effects are mediated by psychosocial variables; (2) having a college education is protective for men only; (3) prior perpetration (ever) is a risk factor for men, but for women only if perpetration was within prior 90 days to the victimization incident. We concluded that alcohol-related problems, psychosocial factors, demographics, and prior perpetration history are independent risk factors for spouse abuse victimization, and that these associations vary by gender. These findings appear in a manuscript titled, "Gender Differences in Risk Factors for Victims of Spouse Abuse: Behavioral, Psychosocial, and Demographic Patterns" which is currently under review at the *American Journal of Preventive Medicine*. A copy of this manuscript under review is attached in Appendix A.

We have also completed **Paper 11,** "Health and occupational consequences of spouse abuse victimization among male active duty US Army soldiers" to explore long-range outcomes of male victims of violence and the role of alcohol in predicting occupational and health outcomes. We hypothesized that victims of spouse abuse, particularly male victims who may face additional gender-related stigmatization related

to being abused by their spouse, would be likely to suffer adverse health and occupational or social outcomes. Male victims of spouse abuse have not been studied as extensively as female victims. Some of the established health consequences associated with being a female victim of spouse abuse include increased risk for alcohol abuse or other mental health problems, physical disability, chronic illness, recurrent injury, economic loss. It is not clear whether the health consequences for male victims of spouse abuse are similar to the health consequences established in the literature for female victims of spouse abuse. We hypothesize that male victims of spouse abuse will suffer increased risk for subsequent physical and mental health problems and occupational attrition than nonvictims. Based on the literature which has identified different patterns of outcomes for women in bi-directional versus uni-directional abuse, we also hypothesize that males, who are both victims and perpetrators of spouse abuse, will differ in terms of their demographic profile and their health outcomes from victims who are not reported to be perpetrators. In addition, male victims with a prior spouse abuse perpetrator record might be more likely to fight back which could either escalate injury risk (because of more violence) or improve outcomes if it means he is less likely to feel helpless and ineffective. On the other hand, there is some evidence in the literature suggesting that men who report violence may be acting in a retaliatory manner after their spouse files a report for them. Thus, victims who are also perpetrators may include men who are retaliatory by nature.

The ability to examine risk factors for male victims of spouse abuse is an important strength of this study because less is known about female to male intimate partner violence than about male to female violence and what is known has been hotly argued by researchers.

The total study population consisted of 87,426 soldiers: 11,294 spouse abuse victims who prior perpetrators; 3,277 spouse abuse victims who were never in the ACR as perpetrators of spouse abuse, and 72,855 non-victims. A total of 14,963 soldiers (17.12%) in the study population experienced a hospitalization during the follow-up period, 21.13% of spouse abuse victims who were also perpetrators of abuse, 19.93% of spouse abuse victims who were never perpetrators of abuse, and 16.37% of non-victims. Less than 1% (0.62%) of the hospitalizations occurred within a week of the spouse abuse event and only about a quarter of the events occurred within the first year following the spouse abuse event date. The most common diagnoses among nonvictims were treatment for an old disruptive anterior cruciate ligament, unilateral inguinal hernia, lumbar disc displacement, sterilization and acute appendicitis. In contrast, victims were more likely to be hospitalized with mental health or substance abuse treatment disorders: Victim/perpetrator top diagnoses included brief depressive reaction, adjustment reactive-emotional/conduct disorder, acute appendicitis, alcohol dependence and Victim/non-perpetrator top diagnoses were brief depressive reaction, alcohol dependence, old disruptive anterior cruciate ligament, unilateral inguinal hernia, adjustment reaction/emotional/conduct disorder, and alcohol dependence.

In multivariate Cox proportional hazard models victims of spouse abuse were at significantly greater risk for hospitalization during the follow up. This was particularly

true of victims who were also prior perpetrators. Spouse abuse victim/perpetrators are sat highest risk with HR of 1.45 (95% CI = 1.38-1.52) followed by victim nonperpetrators with a HR of 1.38 (95% CI of 1.27-1.49) as compared to nonvictim controls. In victim only models, the inclusion of event factors such as perpetrator and mutual drinking during the spouse abuse event and severity completely mediated the association between prior perpetrator status and increased risk for hospitalization. There was not significant difference between victims with and without prior perpetrator history.

We also explored the relationship between spouse abuse victimization and early discharge from the Army. 57,524 out of 87,426 in the total study population (65.8%) were discharged from the Army between the abuse event date and the end of the follow-up period; 69.5% of spouse abuse victims/perpetrators, 63.3% of victim/nonperpetrators, and 65.3% of nonvictims.   Mean time from abuse event date to discharge was 39.6 months overall, but 29.0 for victim/perpetrators, 27.7 months for spouse abuse victim/nonperpetrators, and 32.2 months for nonvictims.

In multivariate models after controlling for demographic and occupational characteristics such as age, total time in service, rank and occupation, spouse abuse victims are still significantly more likely to have a shorter time on active duty than are soldiers who were never involved in a spouse abuse event. In addition, while both victim types were at increased risk for attrition as compared to the nonvictim controls, inclusion of the demographic variables partially mediated the effect of victimization for those without prior perpetrator history (HR went from 1.18, 95% CI 1.13-1.24 in the unadjusted model to 1.05, 95% CI 1.02-1.08). But, the HR for those with prior perpetrator history was largely unchanged by the inclusion of covariates in the model (went from 1.13, 95% CI 1.10-1.15 to 1.13, 95% CI 1.08-1.18). In addition, in the victim only model once perpetrator and mutual drinking as well as severity was in the model, prior perpetrator status actually became slightly protective against early discharge from the Army (HR = 0.92, 95% CI = 0.87-0.97).

In conclusion, data from this study indicate that male victims are at increased risk for future serious health problems (hospitalization). Very long lag time between the initial spouse abuse event and hospitalization date suggest that these hospitalizations are unrelated to the initial spouse abuse incident event. They may be due to injury experienced after a second (recurrent) episode of spouse abuse. But, the distribution of the diagnoses (more mental health than injuries) suggests rather that they are more likely the indirect long-term outcomes of IPV victimization OR the factors that covary with IPV victimization. Depression and other mental health diagnoses as well as alcohol dependence syndrome were among the more common hospital diagnoses for male victims of violence, whereas knee injuries, hernias and back injuries were the most common diagnoses among nonvictims hospitalized during the follow-up period. Male victims were at increased risk for hospitalizations occurring five or more years after the initial IPV abuse event date. This suggests that either the IPV is ongoing or factors related to the initial abuse event persist, or that the health consequences of the initial act of violence persist. Either way, male victims are in need of more support services. More research is needed to better understand the persistence of this association.

Education was a consistent protective factor in all the models suggesting it deserves further exploration as a potential intervention tool.

The manuscript is currently undergoing internal peer review at the Uniformed Services University of the Health Sciences. As such, results should be seen as preliminary (see attached draft in Appendix A).

Paper 12 (Intentional injury victims and perpetrators in the U.S. Army: variations in the pathway to violence).

We have completed work on the first of a two part series addressing variations in the pathways that result in different types of intentional injury and in particular how alcohol and injury hospitalizations fit into the overall model predicting the various pathways to different adverse injury outcomes including: suicide, homicide, assault, spouse abuse victimization, spouse abuse perpetration and child abuse perpetration.

The first paper is completed and is undergoing peer review (see attached draft of Paper 12). Summary of findings from this first effort, which focuses on soldiers with only one event, are presented here. We have also begun analysis on the companion paper which focused on multiple intentional injury events. Data from preliminary findings of multiple intentional injury events are presented below in the next section of this report (Paper 13). **Paper 12** begins with the selection of cases and controls from the entire Army as the study population to compare the similarities and differences in the causal pathway that leads up to an intentional injury event including assault victimization, spouse abuse victimization, spouse abuse perpetration, child abuse perpetration, suicide and homicide. While the literature suggests the risk factors for each of these outcomes is similar, we hypothesize that there may be important mediation factors in the causal process that helps determine whether an act of violence is turned inwards towards oneself or inflicted on another person AND whether or not the outcome is lethal. Data have been collected and early analysis begun. Multinomial logistic regression analyses were conducted to examine the associations between demographic characteristics and type of prior hospitalization for each of the intentional injury outcomes with control as the referent category. This analysis was based on those respondents with a single outcome event (n = 276,417; cases = 92,139 and control = 184,278). A similar analysis was conducted for those respondents who completed an HRA questionnaire (n = 37,496; cases = 12,141 and controls = 25,355). In view of the large number of HRA variables, this analysis was conducted in two stages. In the first stage, we conducted the multinomial logistic regression analyses for all demographic, hospitalization, and HRA variables. In the second stage we excluded all non-significant variables.

Analysis among the two random sub-samples of cases yielded comparable results and the findings from the total sample are presented here. There were 276,417 study subjects of which 184,278 were controls. Among the 92,139 cases there were 1,646 suicides (0.6% of total) and13,247 hospitalized victims of personally-inflicted injury (4.79%); 24,546 spouse abuse perpetrators (8.88%) and 22,667 child abuse

perpetrators (8.20%), and 17,981 hospitalized victims of assault (6.51%), 682 homicide (0.25%) victims and 11,370 spouse abuse victims (4.11%).

Injury to self: male gender was associated with increased risk for suicide but protective for non-fatal self-inflicted injury. Age was not related to completed suicide but younger age was a risk factor for non-fatal self-inflicted injury. Similarly, lower rank and shorter time in service were also risk factors for non-fatal self-inflicted injury but not for completed suicide. Blacks and Hispanics were at lower risk for both suicide and suicide attempts than whites. Married and previously married individuals were also at greater risk for self-inflicted injury as were soldiers with more dependents (children). Number of dependents was not related to completed suicide. Receipt of special pay for hazardous duty exposures and college education were protective for both suicide attempt and completed suicide.

Injury to others: male gender was positively associated with spouse abuse perpetrator but females were at greater risk for child abuse perpetrator. Younger age, shorter time in service, and lower rank were also risk factor for spouse and child abuse perpetrator, as were marital status and larger families (more than 3 dependents). Minority race was associated with an increased risk for perpetration of spouse abuse (increased risk among black, Hispanic, Asian and Native Americans compared to white). Black soldiers were at greater risk than white soldiers for child abuse perpetration while Hispanics were less likely than whites to be child abuse perpetrators. Receipt of hazardous duty pay was associated with increased risk for spouse abuse perpetration. College education (two year degree or more) was protective reducing risk for both spouse and child abuse perpetration.

Intentional Injury Victim: male gender was associated with increased risk for assault victimization. But female gender was associated with spouse abuse victimization. Gender was not related to homicide. Soldiers under age 40 were at greater risk for all intentional injury victimization outcomes and soldiers of lower rank (E1-E4) or with shorter time in service (less than 10 years) were at risk for assault-related hospitalizations. Black race was associated with increased risk for IPV (spouse abuse victimization) and greater risk for homicide, but lower risk for non-fatal assault-related hospitalizations than white soldiers (referent). Hispanic and Asian soldiers were also less likely to experience non-fatal assault hospitalizations but Native Americans were at greater risk. Marriage was protective for assault. Though it was positively associated with spouse abuse this may be largely due to Army case definition for spouse abuse. Greater number of children was associated with increased risk for spouse abuse victimization but was unrelated to homicide. Receipt of hazardous duty pay was associated with increased risk for IPV (spouse abuse victimization) but lower risk for assault-related hospitalization and homicide. College education was protective against both assault-related hospitalizations and homicide.

Prior Hospitalizations: Prior hospitalizations for alcohol abuse, other mental disorders or for a prior injury were associated with all of the intentional injury outcomes with the sole exception of homicide. Mental health prior hospitalizations are particularly

potent predictors of self-inflicted non-fatal and fatal injury. But all three types of prior hospitalizations (mental health, alcohol and prior injury) are significant predictors of subsequent intentional injury outcomes.

In a sub-analysis of soldiers who had completed an Army Health Risk Appraisal (HRA) survey (N = 37,496) we found that prior alcohol-related hospitalization, mental health and injury hospitalizations were still predictive of most outcomes. Of the HRA alcohol items, the CAGE was not associated or only very weakly associated only one outcome: spouse abuse perpetration. Heavy weekly drinking, however, was associated with increased risk for spouse abuse perpetration, homicide, non-fatal assault hospitalization, but not spouse abuse victimization or child abuse perpetration.

Some variables associated with the outcome do not suggest an obvious causal pathway and are therefore expected to be proxy measures of an underlying or latent factor. For example, smoking is associated with most of the adverse outcomes as was seatbelt low usage rates. Both of these factors have been identified in another study as indicators for low self esteem (21). However, without a direct means of measuring self-esteem this hypothesis must be further tested to confirm.

As with the prior study of male victims of spouse abuse, college education (two year degree or more) was a persistent protective factor for all outcomes. Because of the study design causal order cannot be assessed with regard to education. But, again, it does suggest that further investigation of the protective effect of education should be carefully considered. A draft of Paper 12 is provided in Appendix A.

Paper 13 is in the early stages of analysis. The basic initial study population is the same as described above under paper 12. But for this companion paper we also include soldiers who experienced multiple intentional injury outcomes. We conducted a multiple logistic regression comparing all cases with multiple outcomes with single outcome cases as referent (n = 121,695; multiple outcome cases = 29,556 and single outcome cases =92,129). Analyses were conducted in SAS, version 8.2 (2).

Among respondents with multiple outcomes, we also conducted a latent class analysis (LCA) based on the outcome variables. LCA identifies subgroups of the study population which are expressed as latent class categories. Due to the small numbers for completed suicide and homicide, these variables were excluded from the model and the LCA was based on the other 5 categorical outcomes (presence/absence): spouse abuse perpetrator, spouse abuse victim, child abuse perpetrator, hospitalized victim of assault, and hospitalized victim of personally-inflicted injury. Because covariates can influence class solutions, demographic and hospitalization variables were included in the model (23). To avoid local maxima, the log likelihood values of the best solution were replicated over several sets of random starting values. Model selection regarding the number of appropriate classes was based on log likelihood values (Log L), the number of parameters, and Bayesian Information Criteria (BIC). LCAs were calculated for two to four classes. Characteristics of the selected class were based on endorsement probabilities for each criterion and a multinomial logistic regression

analysis of the covariates was conducted with the largest normative class as the referent. The analyses were implemented in the computer program Mplus (24).

Preliminary results are summarized here and presented in Tables 2-6 below. Soldiers with multiple outcomes, compared to single outcomes, are less likely to have prior hospitalizations and higher proportions for other background characteristics, including more minorities and hazard duty pay.

In order to examine associations between outcomes, latent class analysis was conducted on 5 of the outcomes (suicide and homicide victims were excluded due to small numbers). The analysis yielded 4 groups (the maximum permitted) as follows: all outcomes (3%); family violence with child perpetrators (6%); family violence without child perpetrators (24%); negative for all outcomes (66%).

Variables common for all outcomes are married status, presence of 3 or more dependents, younger age, black race, non-college education, and prior hospitalization for alcohol, other mental disorders, and injury.

Variables which differentiate these outcome groups include gender, Hispanic ethnicity, and hazard pay. Males and Hispanics are more likely to have family violence with and without 3 or more dependents. Soldiers with hazard pay for parachute duty are more likely to have family violence with spouse and 3 ore more dependents.

Preliminary results are summarized in Tables 2-6 below. Future work will incorporate exposure (time in the Army and discharge) and more focus on path analysis.

<u>Table 2. Odds ratios (CI) comparing soldiers with multiple outcome with soldiers with single outcome as referent.(n=121,695).</u>

Risk factors	Multiple vs. Single Cases
	OR (CI)
Gender	
Women	1.00
Men	1.41*(1.10-1.19)
Age	
<21	1.29*(1.11-1.50)
21-25	1.67*(1.45-1.93)
24-30	1.49*(1.29-1.71)
31-35	1.31*(1.14-1.49)
36-40	1.18*(1.03-1.36)
>40	1.00
Race/Ethnicity	
White	1.00
Black	1.91*(1.85-1.97)

Hispanic	1.35*(1.26-1.44)
Native American/Alaskan	1.23*(1.05-1.46)
Asian/Pac Islander	1.37*(1.22-1.54)
Other	1.50*(1.37-1.63)
Education	
High School (equiv) or less	1.00
Some college	0.74*(0.69-0.80)
College or greater	0.94 (0.84-1.05)
Rank	
E1-E4	1.00
E5-E6	0.95*(0.90-0.99)
E7-E9	0.88*(0.80-0.97)
Officer/Warrant	0.92 (0.80-1.06)
Time in active Service	
<2	0.98 (0.91-1.07)
2-5	1.20*(1.12-1.29)
>5-10	1.10*(1.03-1.16)
>10 years	1.00
Marital Status	
Single	1.00
Married	2.37*(2.28-2.47)
Divorced/Widowed/Separated	1.68*(1.51-1.87)
Dependents	
Member or spouse	1.00
3	0.92*(0.88-0.96)
4	0.83*(0.79-0.87)
5 or more	0.76*(0.72-0.80)
Hazardous Duty Pay 1 year prior event	
None (past year)	1.00
Parachute and other	1.51*(1.44-1.59)
Other hazard pay	1.43*(1.29-1.60)
Hospital 1 year prior to event	
Alcohol	
No	1.00
Yes	0.84*(0.75-0.95)
Mental Health	
No	1.00
Yes	0.71*(0.65-0.77)
Injury	
No	1.00
Yes	0.97 (0.92-1.03)

* p < .01 +p < .05.

Table 3. Item Profiles for Latent Class Analysis of Multiple Outcomes (n=88,668).

Class	1	2	3	4
Class counts	1832	5591	20823	56238
Class proportions	.028	.064	.246	.666
Outcomes				
Assault	0.471	0.004	0.014	0.000
Suicide attempts	0.372	0.001	0.008	0.000
Spouse victim	0.296	0.512	1.000	0.000
Spouse perpetrator	0.440	0.892	1.000	0.000
Child perpetrator	0.271	1.000	0.000	0.000

Table 4. Distributions of demographic items and prior hospitalization by latent class (n=88,668).

Risk factors	Class 1 N=1832	Class 2 N=5,591	Class 3 N=20,823	Class 4 N=56,238	Total N=88,668
	%	%	%	%	%
Gender					
Women	16.66	11.55	15.84	14.96	14.99
Men	83.34	88.45	84.16	85.04	85.01
Age					
<21	18.50	7.80	11.54	15.85	14.32
21-25	44.49	42.69	50.13	33.29	38.31
24-30	22.68	26.65	23.75	19.82	21.30
31-35	9.71	14.58	9.63	13.87	12.78
36-40	3.25	6.90	3.88	10.17	8.26
>40	1.27	1.38	1.07	7.0	5.03
Race/Ethnicity					
White	50.79	41.55	37.18	64.01	55.62
Black	40.48	47.47	53.26	26.05	34.49
Hispanic	4.12	5.40	4.77	4.88	4.87
Native American/Alaskan	0.65	0.93	0.61	0.61	0.63
Asian/Pac Islander	0.98	1.61	1.43	2.01	1.82
Other	2.98	3.04	2.75	2.44	2.57
Education					
High School (equiv) or less	94.25	92.88	94.55	77.95	83.39
Some College or more	5.75	7.12	5.45	22.05	16.61
Rank					
E1-E4	67.72	56.88	64.76	50.21	54.64
E5-E6	27.51	35.43	29.85	25.17	27.05
E7-E9	3.58	5.53	3.66	9.61	7.74
Officer/Warrant					10.57

Time in active Service					
<2	33.97	19.26	21.59	25.21	24.12
2-5	32.23	33.52	39.17	27.40	30.81
>5-10	22.19	26.83	26.00	20.18	22.10
>10 years	11.61	20.39	13.24	27.21	22.97
Marital Status					
Single	35.86	13.84	18.99	42.06	34.22
Married	62.24	84.14	79.29	54.02	62.47
Divorced/Widowed/ Separated	1.90	2.02	1.72	3.92	3.21
Dependents					
Member or spouse	55.29	31.16	52.24	62.22	57.56
3	19.70	24.77	23.18	14.52	17.44
4	16.60	24.82	15.87	14.76	15.74
5 or more	8.41	19.25	8.71	8.50	9.26
Parachute Hazardous Duty Pay 1 year prior event					
None (past year)	90.83	87.46	90.40	88.20	88.75
Parachute and other	9.12	12.54	9.60	11.80	11.25
Hospital 1 year prior to event					
Alcohol					
No	97.34	98.37	98.72	98.99	98.85
Yes	2.66	1.63	1.28	1.01	1.15
Mental Health					
No	95.88	97.84	97.90	98.82	98.46
Yes	4.12	2.16	2.10	1.18	1.54
Injury					
No	93.27	93.95	94.31	95.02	94.74
Yes	6.73	6.05	5.69	4.98	5.26

Table 5. Odds ratios (CI) for 3 latent classes with class 4 as referent (n=88,668).

Risk factors	Class 1 N=1832	Class 2 N=5,591	Class 3 N=20,823
	OR (CI)	OR (CI)	OR (CI)
Gender			
Women	1.00	1.00	1.00
Men	0.99 (0.86-1.13)	1.31*(1.19-1.44)	1.17*(1.11-1.23)
Age			
<21	5.04*(2.73-9.28)	4.37 (3.24-5.89)	4.25*(3.55-5.10)
21-25	5.21*(2.88-9.45)	5.85*(4.44-7.30)	4.98*(4.29-5.90)
24-30	4.33*(2.41-7.76)	4.23*(3.25-5.20)	3.44*(2.92-4.05)

31-35	3.28*(1.86-5.80)	3.17*(2.46-4.08)	2.36*(2.01-2.75)
36-40	2.19*(1.22-3.91)	2.31*(1.78-2.98)	1.60*(1.36-1.88)
>40	1.00	1.00	1.00
Race/Ethnicity			
White	1.00	1.00	1.00
Black	1.90*(1.71-2.10)	2.65*(2.48-2.83)	3.38*(3.25-3.51)
Hispanic	0.92 (0.72-1.17)	1.33*(1.16-1.52)	1.48*(1.36-1.61)
Native American/Alaskan	1.21 (0.67-2.16)	2.16*(1.56-2.97)	1.60*(1.28-2.00)
Asian/Pac Islander	0.68 (0.43-1.10)	1.42*(1.13-1.79)	1.46*(1.26-1.68)
Other	1.47*(1.11-1.94)	1.64*(1.38-1.95)	1.80*(1.61-2.00)
Education			
High School (equiv) or less	1.00	1.00	1.00
Some college or greater	0.74*(0.58-0.92)	0.73*(0.64-0.84)	0.63*(0.58-0.69)
Rank			
E1-E4	6.94*(4.28-11.25)	5.73*(4.54-7248)	4.68*(4.06-5.39)
E5-E6	2.76*(1.70-10.88)	4.00*(3.21-4.99)	3.46*(3.02-3.97)
E7-E9	4.86*(2.84-8.32)	2.23*(1.74-2.85)	2.25*(1.93-2.63)
Officer/Warrant	1.00	1.00	1.00
Time in active Service			
<2	3.84*(2.66-4.72)	1.67*(1.42-1.86)	1.48*(1.37-1.65)
2-5	2.44*(1.87-3.19)	1.71*(1.48-1.97)	1.80*(1.64-1.97)
>5-10	1.74*(1.39-2.18)	1.27*(1.14-1.43)	1.39*(1.28-1.50)
>10 years	1.00	1.00	1.00
Marital Status			
Single	1.00	1.00	1.00
Married	2.32*(2.03-2.66)	4.31*(3.89-4.76)	5.65*(5.37-5.94)
Divorced/Widowed/ Separated	1.30 (0.91-1.86)	2.71*(2.18-3.37)	3.34*(2.06-2.66)
Dependents			
Member or spouse	1.00	1.00	1.00
3	1.46*(1.26-1.69)	2.26*(2.06-2.47)	1.16*(1.10-1.22)
4	1.88*(1.60-2.12)	3.44*(3.17-3.79)	1.19*(1.12-1.26)
5 or more	2.44*(1.97-3.02)	6.52*(5.82-7.29)	1.59*(1.47-1.72)
Parachute Hazardous Duty Pay 1 year prior event			
None (past year)	1.00	1.00	1.00
Parachute and other	0.90 (0.76-1.06)	1.37*(1.25-1.51)	1.02 (0.96-1.09)
Hospital 1 year prior to event			
Alcohol			
No	1.00	1.00	1.00
Yes	2.10*(1.51-2.42)	1.51*(1.17-1.95)	1.31*(1.11-1.55)
Mental Health			
No	1.00	1.00	1.00
Yes	2.85*(2.18-3.73)	1.66*(1.32-2.07)	1.85*(1.61-2.14)
Injury			

No	1.00	1.00	1.00
Yes	1.52*(1.25-1.84)	1.18*(1.04-1.35)	1.21*(1.11-1.31)

* p < .01 +p < .05.

Table 6. Odds ratios (CI) within latent classes 1-3.

Risk factors	Class 1 (Class 2 referent) N=7434	Class 2 (Class 3 referent) N=22,666	Class 2 (Class 3 referent) N=36,414
	OR (CI)	OR (CI)	OR (CI)
Gender			
Women	1.00	1.00	1.00
Men	0.69*(0.59-0.82)	0.84*(0.73-0.96)	1.07 (0.98-1.15)
Age			
<21	1.37 (0.70-1.67)	1.14 (0.61-2.14)	0.89 (0.64-1.24)
21-25	1.01 (0.53-1.94)	0.98 (0.53-1.81)	1.06 (0.78-1.44)
24-30	1.08 (0.57-2.05)	1.17 (0.64-2.15)	1.13 (0.84-1.53)
31-35	1.03 (-.55-1.93)	1.32 (0.74-2.38)	1.26 (0.94-1.69)
36-40	0.88 (0.47-1.69)	1.29 (0.71-2.36)	1.41+(1.05-1.90)
>40	1.00	1.00	1.00
Race/Ethnicity			
White	1.00	1.00	1.00
Black	0.68*(0.60-0.76)	0.57*(0.51-0.63)	0.79*(0.74-0.84)
Hispanic	0.70*(0.53-0.91)	0.64*(0.50-0.82)	0.93 (0.81-1.07)
Native American/Alaskan	0.55 (0.29-1.07)	0.78 (0.42-1.42)	1.28*(0.91-1.79)
Asian/Pac Islander	0.56*(0.33-0.95)	0.48*(0.30-0.78)	0.97 (0.76-1.24)
Other	0.88 (0.64-1.23)	0.82 (0.61-1.09)	0.92 (0.77-1.11)
Education			
High School (equiv) or less	1.00	1.00	1.00
Some college or greater	1.12 (0.85-1.46)	1.19 (0.93-1504)	1.06 (0.91-1.23)
Rank			
E1-E4	1.11 (0.64-1.92)	1.44 (0.87-22.39)	1.22 (0.94-1.60)
E5-E6	1.62 (0.94-2.08)	187**(1.14-3.08)	1.15 (0.89-1.49)
E7-E9	2.01*(1.10-3.66)	1.95*(1.13-3.38)	0.96 (0.72-1.26)
Officer/Warrant	1.00	1.00	1.00
Time in active Service			
<2	2.13*(1.55-2.53)	2.34*(1.75-3.13)	1.10 (0.93-1.30)
2-5	1.35+(1.00-1.82)	1.35+(1.03-1.78)	0.99 (0.85-1.15)
>5-10	1.29+(1.01-1.65)	1.24 (0.98-1.57)	0.92 (0.82-1.05)
>10 years	1.00	1.00	1.00
Marital Status			
Single	1.00	1.00	1.00
Married	0.50*(0.43-0.58)	0.40*(0.34-0.45)	0.80*(0.73-0.88)
Divorced/Widowed/			

Separated	0.49 (0.32-0.74)	0.53*(0.36-0.76)	1.11 (0.88-1.41)
Dependents			
Member or spouse	1.00	1.00	1.00
3	0.62*(0.53-0.74)	1.22*(1.06-1.41)	1.91*(1.75-2.09)
4	0.54*(0.60-0.64)	1.56*(1.33-1.83)	2.76*(2.52-3.03)
5 or more	0.37*(0.97-0.47)	1.48*(1.20-1.83)	3.90*(3.50-4.36)
Parachute Hazardous Duty Pay 1 year prior event			
None (past year)	1.00	1.00	1.00
Parachute and other	0.64*(0.53-0.77)	0.90 (0.76-1.07)	1.34*(1.22-1.48)
Hospital 1 year prior to event			
Alcohol			
No	1.00	1.00	1.00
Yes	1.35 (0.91-2.01)	1.68*(1.20-2.34)	1.10 (0.85-1.42)
Mental Health			
No	1.00	1.00	1.00
Yes	1.93*(1.40-2.67)	1.65*(1.27-2.16)	0.94 (0.76-1.17)
Injury			
No	1.00	1.00	1.00
Yes	1.30*(1.03-1.62)	1.25*(1.03-1.53	0.96 (0.84-1.09)

SUMMARY STATUS OF STATEMENT OF WORK TASK PROGRESS

Legend: √ = **Complete** □ = **Initiated**

SOW#	Task	Status
1	Hire staff, obtain and link data, error check, human use review stuff	√
2	Identify cases with alcohol diagnoses in the hospital discharge data. Calculate incidence and prevalence rates of alcohol diagnoses as both principle and secondary diagnoses	√
3	Develop linkage between cases in hospitalization databases; obtain, analyze, and link data from mortality databases with hospitalization records.	√
4	Begin preparation of paper on the prevalence of alcohol diagnoses in the Army.	√
5	Prepare the first series of papers describing the epidemiology of alcohol diagnoses and injuries in the Army.	√
6	Initiate detailed analytic studies using linked hospitalization, mortality and other military databases, compare injury risk in women to rates in men by occupation and other variables, for those with and without alcohol diagnoses.	√
7	Initiate cohort study of recurrent injury in relation to alcohol use.	√
8	Compare the distribution of injuries in those with and without alcohol diagnoses.	√
9	Explore linkage with other military databases such as safety center, disability data, and outpatient data.	√
10	Complete papers on the distribution of injuries.	□
11	Complete detailed analytic studies begun in Year 2 of specific types of injuries.	√
12	Complete cohort studies of alcohol problems and injury risk studies begun in Year 2.	□
13	Develop final estimates of the risk of injury associated with alcohol diagnoses; deaths and hospitalized injuries.	□
14	Analyze outpatient data and replicate models using these data.	√
15	Prepare final report and manuscripts describing study findings, define future research areas, and develop recommendations for interventions to reduce alcohol-related injuries in the military.	√

KEY RESEARCH ACCOMPLISHMENTS

- Incorporated new databases to the TAIHOD.
- Made significant strides in understanding administrative databases that will have implications for future studies.
- Completed ten papers and reports that are either published, under review at a journal or internally, or in the process of being revised and resubmitted per reviewer comments.
- Completed most of the analyses on an additional three papers.
- Presented findings from research supported by this grant at two conferences.

LIST OF PERSONNEL INVOLVED IN EFFORTS

Name	Organization
Nicole Bell	SSDS, Inc.
Ilyssa Hollander	SSDS, Inc.
Carolyn Schwartz	SSDS, Inc.
Cara Fuchs	SSDS, Inc.
Margaret Phillips	SSDS, Inc.
Laura Senier	SSDS, Inc.
Paul Amoroso	Madigan Army Medical Center
Jonathan Howland	Boston University, School of Public Health
Thomas Harford	Boston University, School of Public Health
Les MacFarling	Army Substance Abuse Program
James E. McCarroll	Uniformed Services University of the Health Sciences
Katy Benjamin	SSDS, Inc., and United BioSource, Inc.

PLANS

- Complete submission and revision process with articles currently under review at *Journal of Interpersonal Research, Addiction, American Journal of Preventive Medicine, Annals of Emergency Medicine and Military Medicine* as well as article still in preparation.

- Close human subjects protocol with the Human Use Review Committee at the USARIEM Institutional Review Board and with the Human Research Protections office, formerly the Human Subjects Research Review Board, at US Medical Research and Material Command.

REPORTABLE OUTCOMES

PUBLISHED MATERIALS

- Bell NS, Amoroso PJ, Senier L, Williams JO, Yore MM, Hollander IE. The Total Army Injury and Health Outcomes Database (TAIHOD): Uses and Limitations as a Research Tool for Force Health Protection. TN05-01. ADA427201. US Army Research Institute of Environmental Medicine, Natick, MA. September 2004.

- Hollander IE, Bell NS, Phillips M, Amoroso PJ, McFarling L. A Descriptive Study of U.S. Army Soldiers Referred to, Evaluated by, and Enrolled in the Army Substance Abuse Program, 1988-2003. T06-08. ADA455935. Technical Report. *US Army Research Institute for Environmental Medicine.* September 2006.

- Bell NB, Fuchs CH. Spouse abuse is an important public health problem facing the military. Prepared for the Department of Psychiatry at the Uniformed Services University of the Health Sciences Newsletter, *Joining Forces*. March 2005.

MANUSCRIPTS UNDER PEER-REVIEW AT JOURNALS OR INTERNAL REVIEW PROCESS/MANUSCRIPTS BEING REVISED AND RESUBMITTED TO JOURNAL PER REVIEWER RECOMMENDATIONS

- Benjamin KL, Bell NS, Hollander IE. A historical look at Alcohol Abuse trends in Army and civilian populations. Under review at *Military Medicine*.

- Howland J, Bell NS, Hollander IE. Causes and nature of injury among Army soldiers hospitalized with alcohol comorbidity. Under review at *Addiction*.

- Bell NS, Hollander IE, Amoroso PJ. Alcohol abuse history, health behaviors and psychosocial risk factors for assault-related hospitalizations among active duty Army soldiers. Under review at *Annals of Emergency Medicine*.

- Bell NS, Harford TC, Amoroso PJ, Hollander IE. Alcohol abuse and alcoholism, mental health disorder, and injury hospitalization history and other risk factors for completed suicide: A case-control study of 7,492 enlisted Army soldiers. Under review at *Addiction*.

- Schwartz CE, Bell NS, Hollander IE, Amoroso PJ. Gender differences in risk factors for victims of spouse abuse: behavioral, psychosocial and demographic patterns. Under review at *American Journal of Preventive Medicine*.

- Bell NS. Health and occupational consequences of spouse abuse victimization among male US Army soldiers (Undergoing internal peer review at Uniformed Services University of the Health Sciences).

- Bell NS, Harford TC. Intentional injury victims and perpetrators in the U.S. Army: Is a college education the answer? (Draft Manuscript – In preparation to undergo peer review at Uniformed Services University of the Health Sciences).

PROCEEDINGS AND ABSTRACTS

- Hollander IE & Bell NS. Army Substance Abuse Program: A look at soldiers referred and enrolled for alcohol abuse. *American Public Health Association. 134th Annual Meeting: Public Health and Human Rights*. Boston: November 4-8, 2006.

- Benjamin K, Hollander I, Toboni H, Bell N. Measuring hospital episodes of care for use in alcohol and injury epidemiological studies. *Department of Defense, Peer Reviewed Medical Research Program (PRMRP) Investigators Meeting*. Puerto Rico: April 26-28, 2004.

MANUSCRIPTS NEARING COMPLETION

- Bell NS, Hollander IE, Williams JW. Intentional and unintentional injury hospitalization and alcohol comorbidity trends among US Army soldiers, 1980-2003.

- Bell NS, Hollander IE and Williams JW. Risk for relapse, injury and other adverse outcomes among Army soldiers who have completed alcohol treatment between September 1988 and August 2003.

- Bell NS, Harford TC. Single and multiple intentional injury events: comparison of etiological pathways to violence.

CONCLUSIONS

- TAIHOD hospitalization files provide rich data for the exploration of both alcohol and injury. The use of narrative text to enhance understanding of the nature and cause of an injury as well as specific circumstances surrounding the event is a particular strength. In addition, data can be used to separate unique events from hospital records produced when an injured person is transferred to continue care. This is also a major strength of the database.

- Researchers that use large, administrative military hospital databases must use caution in using and interpreting data. Data collected for purposes other than research may be incomplete or insufficient for use in epidemiological studies.

- Rates for Army alcohol-related hospitalizations were higher than civilian rates through most of the 1980s; this trend began to reverse in the early 1990s. This pattern appears to be driven largely by a drop in the number of nondependent alcohol abuse cases among military personnel. Possible reasons for this observation include: increased screening for drugs and alcohol abuse in the Army, improvements in alcohol abuse prevention and treatment programs, changes in policies regarding tolerance of substance abuse in military personnel, demographic shifts in the Army population towards older and increasing numbers of female soldiers; fewer inpatient alcohol cases due to changing patterns of treatment, the advent of managed care, and the availability of more outpatient treatment programs within the military.

- Army rates for severe alcohol-related disorders such as, alcohol psychosis, and alcohol-related liver disorders, have been consistently lower than those observed in the civilian population. Again, this may be due to a combination of factors, including pre-enlistment screening for substance abuse, low tolerance of severe substance abuse in the military, and health or legal problems that would render those with serious alcohol problems unfit for military service.

- Soldiers who were enrolled in substance abuse programs for alcohol-related reasons were more likely to be white, male, and young (18-25), of lower rank (E1-E4) and were less well-educated than the military population as a whole. These characteristics are similar to those found among alcohol abuse patients in the civilian population.

- Hispanics and no-longer-married Soldiers were both more likely than others to be referred to ASAP for evaluation following a DUI charge. This finding indicates the need for more research into the etiology of this association and possibly the need for targeted prevention efforts.

- Self-referred Soldiers who were not enrolled at their first evaluation were more likely than Soldiers referred by other mechanisms to be enrolled at a later date

following a subsequent evaluation. It is possible that self-proclaimed alcohol abusers are not receiving proper attention or treatment after their first evaluation. Treating these individuals sooner may expedite rehabilitation and a more productive return to duty.

- Alcohol-related hospitalizations and injury related hospitalizations both serve as sentinel events and increase the likelihood of future adverse events including suicide and spouse abuse victimization. For suicide, prior injury (OR = 1.96, 95% CI = 1.59-2.43), alcohol (OR =3.37, 95% CI = 2.30-4.94), and mental health hospitalizations (OR = 6.63, 95% CI = 4.77-9.20) were all associated with an increased risk for suicide. Most injury hospitalizations were unintentional but were, nonetheless, associated with increased risk for subsequent suicide, particularly when the cause of injury was guns or poisoning, but also for machinery and fall-related injuries. For spouse abuse victimization, prior hospitalizations were a significant risk factor for being a victim spouse abuse for both genders.

- Results from our analyses point to the need for more research into the interactions and variations in patterns of risk apparent for men and women and across racial/ethnic groups. Some of our work resulted in the generation of hypotheses that should be tested in other populations. For example, our work under Paper 8 suggests that alcohol abuse may be capturing the latent variable “self-esteem.” It may be that low self-esteem, which is manifest differently in men and women, is a major factor contributing to risk for assault.

- Analyses on experience assault (Paper 8) also show that heavy drinking, but not symptoms of alcohol dependence, is associated with risk for future assaults. Future research should test the safetybelt use, smoking and violence association and hypothesized link to self-esteem as latent factor predicting assault.

- U.S. Army soldiers hospitalized with an injury with alcohol comorbidity differed from their injured peers without alcohol comorbidity in their demographic characteristics, the types and causes of injury, and average LOS to treat their injuries. Alcohol comorbidity was associated with head injury, poisonings, and open wounds, whereas the absence of alcohol comorbidity was associated with lower extremity musculoskeletal injury. Alcohol comorbidity was associated with falls and fights, whereas the absence of comorbidity was associated with sports-related injuries. Average LOS was shorter for those with alcohol comorbidity, with the exception of those being treated for lower-extremity musculoskeletal injuries, which were often sports-related.

- Injury related hospitalizations have declined over time and those with an alcohol comorbidity in particular have declined, at least until around 1994. It is not clear why rates for both injuries and alcohol involvement have remained stable, particularly since rates for injury in civilian settings generally continued to decline during this same time period (19).

- Male victims of spouse abuse are at increased risk for adverse health and problems including increased risk for hospitalization due to alcohol abuse, depression, and other mental health disorders. They also experience higher attrition rates from the Army. In particular, victims who were also at one point spouse abusers seem to be at elevated risk for adverse health problems. College education is protective.

- The pathways to intentional injury, though sharing some commonalities, also differ in interesting ways. Black race is generally protective for self-inflicted injury but a risk factor for perpetrating spouse abuse or being a victim of assault or interpersonal violence. Women are at greater risk for perpetrating child abuse and for non-lethal self-inflicted injury but at lower risk for all other intentional injury outcomes. Prior hospitalization for alcohol abuse, other mental health disorders or injury are associated with increased risk for subsequent intentional injury event. For all intentional injury outcomes, college education (AA degree or greater) is protective and warrants further exploration as a potential intervention tool.

RECOMMENDATIONS FOR INTERVENTIONS

- Our research comparing trends in alcohol-related hospitalizations between civilians and Army personnel (Paper 2) supports other evidence indicating that dependent alcoholics have not been as responsive to legal measures as those with nondependent abusive drinking habits, suggesting that different types of alcohol abusers may respond differently to behavioral regulatory attempts. Dependent alcoholics and nondependent alcohol abusers are especially important to reach with effective interventions, as they are both at-risk for poor outcomes. Research focused on effective strategies to reduce consumption and minimize consequences of alcohol use and abuse in these populations is urgently needed. Army screening and intervention initiatives should be designed with an awareness of these trends and varying levels of responsiveness.

- Our findings in Paper 3 demonstrate how different referral processes seem to reach or target different demographic subgroups of the population. Commanders and physicians should therefore be aware of certain characteristics when identifying Soldiers who abuse alcohol, but also keep in mind that alcohol abuse crosses all demographic boundaries. Based on out findings, it may be useful to social services on posts to consider whether their alcohol screening and detection programs may be missing certain demographic subgroups. This information should also be applied to increase both the sensitivity and specificity of screening techniques.

- Results from Paper 3 also show how referred to Army substance abuse prevention training, ADAPT, in lieu of enrollment in ASAP were more likely to have a second incident resulting in enrollment in ASAP for drug or alcohol abuse. This raises questions both about the effectiveness of ADAPT as a prevention program

and about the accuracy of enrollment decisions of the Commander and/or ASAP counselor at a Soldier's first evaluation. The current ADAPT curriculum might need to be revised or implemented more aggressively, or the screening process may need to be reviewed for deciding on enrollment in a more formal treatment.

- Preliminary findings from Paper 6 suggest that efforts to reduce serious injury and concomitant alcohol abuse disorders may have stagnated. More research is needed to understand why rates do not appear to have fallen since the mid 1990s among Army soldiers while they have continued to decline for civilian hospitals.

- Our findings about the nature and cause of injury (Paper 7) are hypothesis generating. Results indicate variation in patterns of both type and nature of injury when alcohol comorbidity is documented. In addition, the apparent protective effect of alcohol-abuse on length of stay for most injuries warrants further research to explain the finding.

- Paper 9 indicated that Soldiers with mental health disorders are discharged from the Army earlier than those with other health problems. Given the strong association between mental health disorders and suicide, longer follow-up of these soldiers is warranted in order to prevent the attempt or completion of suicide.

- Paper 10 provided information on risk factors for victimization of spouse abuse that differed by gender. There are numerous implications of this work for early intervention to prevent spouse abuse. For example, experiencing any hospitalization appears to be associated with an increased risk of victimization, particularly mental health- and injury-related related hospitalizations for either gender, and alcohol- and dual-diagnosis-related hospitalizations for men. Thus, early interventions to prevent spouse abuse might earmark soldiers for psychosocial interventions by following up on soldiers with these diagnoses during the first year after hospitalization.

- Paper 11 documents important long term health and occupational problems faced by male victims of spouse abuse. Even years after the abuse event male victims are at increased risk for depression, alcohol abuse and other mental health disorders than nonvictims. They are also at greater risk for attrition from the Army. More research is needed to determine whether or not male victims receive the necessary support services they need in order to reduce adverse consequences. In addition the protective effect of college education warrants consideration and testing as possible intervention.

- Papers 12 and 13 document commonalities and differences in the pathways to different intentional injury outcomes. Prior mental health, alcohol abuse and injury hospitalizations are strongly predictive of a future intentional injury outcome – for all intentional injury outcomes measured (suicide, homicide, self-inflicted nonfatal injury, spouse abuse perpetration, child abuse perpetration, spouse abuse victimization, and hospitalization for assault-related injury). Education (AA degree

or greater) is protective for nearly all outcomes. Both of these findings should be considered when developing or refining screening and intervention programs for intentional injury prevention.

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APPENDIX A – ARTICLES, REPORTS AND MANUSCRIPTS

Bell NS, Amoroso PJ, Senier L, Williams JO, Yore MM, Hollander IE. The Total Army Injury and Health Outcomes Database (TAIHOD): Uses and Limitations as a Research Tool for Force Health Protection. TN05-01. ADA427201. US Army Research Institute of Environmental Medicine, Natick, MA. September 2004.

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Bell NS, Harford TC. Intentional injury victims and perpetrators in the U.S. Army: Is a college education the answer? (Draft Provided – In preparation to undergo peer review at Uniformed Services University of the Health Sciences).

U.S. ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE

TECHNICAL REPORT NO. TN05-01
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THE TOTAL ARMY INJURY AND HEALTH OUTCOMES DATABASE (TAIHOD): USES AND LIMITATIONS AS A RESEARCH TOOL FOR FORCE HEALTH PROTECTION RESEARCH

U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

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US Army Research Institute of Environmental Medicine
Kansas St.
Natick, MA 01760-5007

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The Total Army Injury and Health Outcomes Database (TAIHOD) is a research tool with great potential for identifying risk factors, documenting adverse health outcomes, and evaluating intervention strategies, among deployed and non-deployed active duty servicemembers. The TAIHOD comprises data from multiple Department of Defense agencies, including records of hospitalizations, outpatient visits, deaths, disabilities, flying duty medical examinations, accident reports, clinical evaluations from Gulf War registrants with the Comprehensive Clinical Evaluation Program (CCEP), and reports of spousal abuse, as well as demographic information, self-reported health behavior information from surveys, and occupational noise exposure data. The TAIHOD thus has great potential for Force Health Protection-related research focusing on the health of servicemembers during armed conflicts and during peacetime activities. Moreover, by virtue of the breadth and depth of the information it contains, it is particularly useful for assessing pre- and post-deployment health for the entire population of Soldiers serving on active duty.

This report describes the component databases of the TAIHOD, highlighting strengths and limitations of each of these data sources. This report also provides information in a "lessons learned" format in the hopes that this will make it particularly useful to other researchers who use some of the same data sources contained in the TAIHOD. We also provide data from our validation and data cleaning activities that not only highlight some of the pitfalls other researchers may wish to avoid when using these data, but also point to some potential areas for future research.

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THE TOTAL ARMY INJURY AND HEALTH OUTCOMES DATABASE (TAIHOD): USES AND LIMITATIONS AS A RESEARCH TOOL FOR FORCE HEALTH PROTECTION RESEARCH

Nicole S. Bell[1]
COL Paul J. Amoroso[2]
Laura Senier[1]
Jeffrey O. Williams[1]
Michelle M. Yore[2]
Ilyssa E. Hollander[1]

[1]Social Sectors Development Strategies, Inc.

[2]Military Performance Division
U.S. Army Research Institute of Environmental Medicine

SEPTEMBER 2004

U.S. Army Research Institute of Environmental Medicine
Natick, MA 01760-5007

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APPENDIX A. CONTACT INFORMATION

For more information on the TAIHOD, or to contact our research staff, call or email us at:

CDR, USARIEM
ATTN: MCMR-EMP (Amoroso)
Kansas Street, Building 42
Natick, MA 01760-5007
(508) 233-4648
paul.amoroso@us.army.mil

LIST OF ACRONYMS

ACIPS	Army Casualty Information Processing System
ADS	Ambulatory Data System
AEDR	Aviation Epidemiology Data Repository
AFIP	Armed Forces Institute of Pathology
ASAP	Army Substance Abuse and Prevention
ASVAB	Armed Forces Vocational Aptitude Battery
AVA	Anthrax Vaccine Adsorbed
CCEP	Comprehensive Clinical Examination Program
CHCS	Composite Healthcare System
CRO	Carded for Record Only
CURR	Center for Unit Records Research
DAMIS	Drug and Alcohol Management Information System
DIOR	Directorate for Information Operations and Reports
DMDC	Defense Manpower Data Center
DOA	Dead on Arrival
DoD	Department of Defense
DOEHRS	Defense Occupational and Environmental Health Readiness System
EREC	Enlisted Records Center
GAO	Government Accounting Office
GWE	Gulf War Era
GWI	Gulf War Illness
HEAR	Health Enrollment Assessment Review
HRA	Health Risk Appraisal
ICD	International Classification of Disease
IPDS	Individual Patient Data System
MEB	Medical Evaluation Board
MEBBITT	Medical Evaluation Board Interim Tracking Tool
MOS	Military Occupational Specialty
MTF	Military Treatment Facility
OCR	Optical Character Recognition
ODS/DS	Operation Desert Shield/Desert Storm
OIF	Operation Iraqi Freedom
PASBA	Patient Administration Systems and Biostatistics Activity
PEB	Physical Evaluation Board
PTSD	Post-traumatic Stress Disorder
SSN	Social Security Number
STANAG	Standardization Agreement
TAIHOD	Total Army Injury and Health Outcomes Database
TDRL	Temporary Disability Retired List
USAMRAA	U.S. Army Medical Research Acquisition Activity
USAPDA	U.S. Army Physical Disability Agency
USARIEM	U.S. Army Research Institute of Environmental Medicine
VA	Veterans Administration

EXECUTIVE SUMMARY

The Total Army Injury and Health Outcomes Database (TAIHOD) is a research tool with great potential for identifying risk factors, documenting adverse health outcomes, and evaluating intervention strategies, among deployed and non-deployed active duty servicemembers. The TAIHOD comprises data from multiple Department of Defense agencies, including records of hospitalizations, outpatient visits, deaths, disabilities, flying duty medical examinations, accident reports, clinical evaluations from Gulf War registrants with the Comprehensive Clinical Evaluation Program (CCEP), and reports of spousal abuse, as well as demographic information, self-reported health behavior information from surveys, and occupational noise exposure data. The TAIHOD thus has great potential for Force Health Protection-related research focusing on the health of servicemembers during armed conflicts and during peacetime activities. Moreover, by virtue of the breadth and depth of the information it contains, it is particularly useful for assessing pre- and post-deployment health for the entire population of Soldiers serving on active duty.

This report describes the component databases of the TAIHOD, highlighting strengths and limitations of each of these data sources. This report also provides information in a “lessons learned” format in the hopes that this will make it particularly useful to other researchers who use some of the same data sources contained in the TAIHOD. We also provide data from our validation and data cleaning activities that not only highlight some of the pitfalls other researchers may wish to avoid when using these data, but also point to some potential areas for future research.

CHAPTER 1: THE TAIHOD DATABASE

INTRODUCTION

The TAIHOD is a large database linking multiple sources of administrative data and health records for all Army Soldiers who have been on active duty since 1971 (over 5 million individuals). A unique subject ID links data from one database component to another, but other information that could be used to identify a particular individual (e.g., name, Social Security Number [SSN]) is removed from the working datafiles. This method affords reliable linkage of a variety of records for the longitudinal study of the relationship between numerous health outcomes and a wide range of putative risk factors. Use of subject IDs, as well as stringent observation of human use protection guidelines and protection of data files allows this research to go forward while protecting the anonymity of individual Soldiers.

The TAIHOD was created in 1994 initially as a tool to facilitate the study of injuries among female Soldiers (8, 10). The TAIHOD structure and its component databases are described in greater detail later in this report. While initially developed for the study of injury in a subset of the Army population, it quickly became apparent that the TAIHOD also holds potential as a ready and powerful tool for the study of other types of health outcomes and for all members of the Army, as well as certain other components such as Army National Guard or Army Reserves.

This extended potential of the TAIHOD as a research tool became apparent when health concerns among Soldiers deployed to Operation Desert Shield/Desert Storm (ODS/DS) were identified concurrently with the realization that few existing data sources, besides the TAIHOD, contained health and behavior data on all Army Soldiers both before and after the war. Soon after ODS/DS, when Soldiers began returning to the United States, reports of unexplained illnesses began to surface. Many Soldiers attributed these illnesses to their service in the Gulf (41). Because the TAIHOD contains extensive data on health behavior and life-stress-related measures, as well as multiple health outcomes, the TAIHOD was identified as an important source of data that might clarify the role of stress and distress and other factors in the development of illnesses among deployed Gulf War Era (GWE) veterans and/or veterans of other conflicts.

In 1998 the TAIHOD team received funding from the U.S. Army Medical Research Acquisition Activity (USAMRAA) to conduct a pilot study to assess the utility of the TAIHOD as a deployment health research tool. The central purpose of this project was to evaluate the etiologic role stress and distress may play in the development of so-called Gulf War Illnesses (GWI). In the process, this project served as a pilot study to identify more general strengths and limitations of the TAIHOD as a tool for deployment health research.

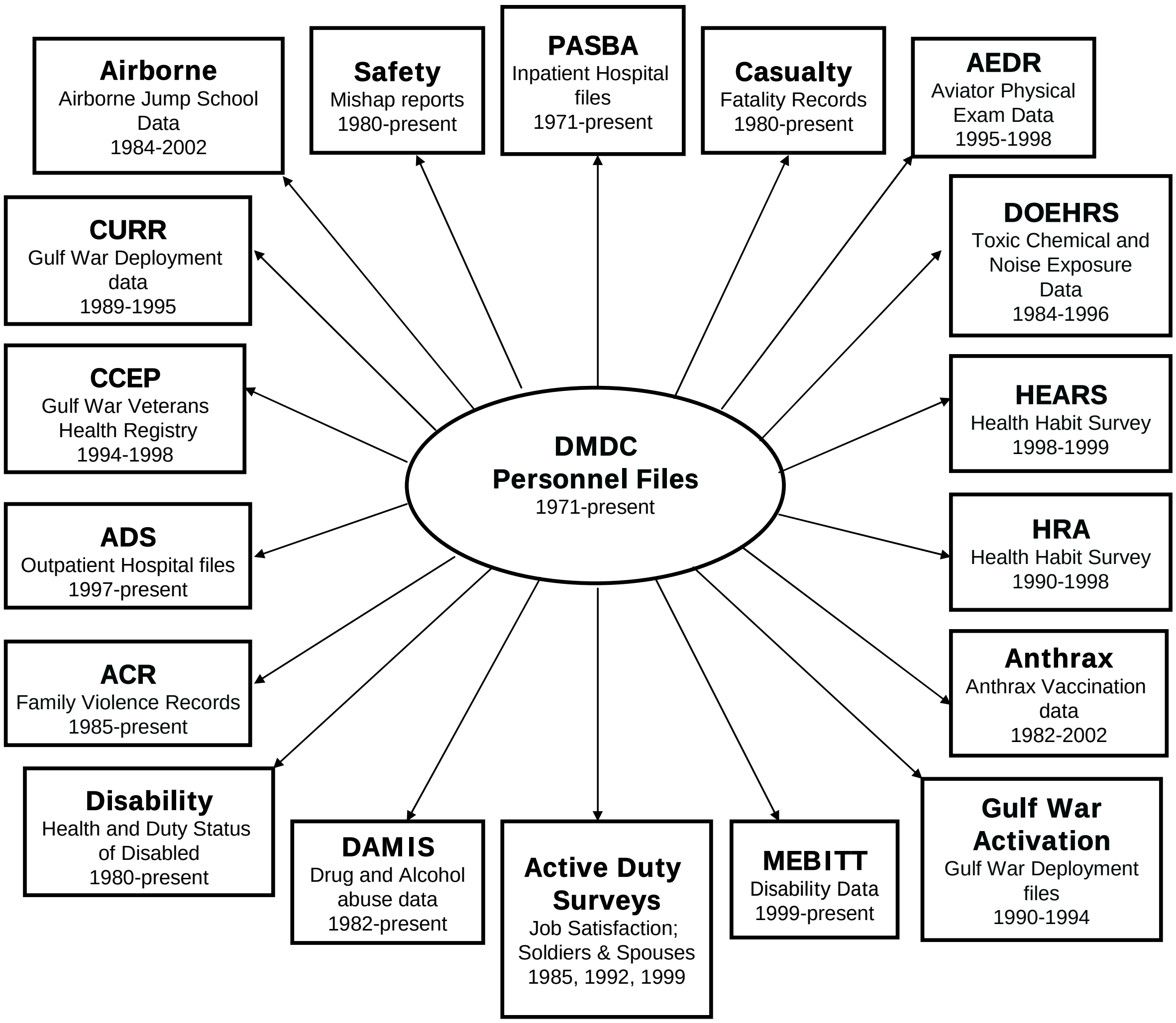
This report documents the strengths and limitations of the TAIHOD as a tool for Force Health Protection-related research with respect to different types of health

outcomes and various risk factors of importance to deployments and Force Health Protection in general (http://www.ha.osd.mil/fhpr/default.cfm). It reviews the challenges and obstacles we have faced in this work, suggests additional research questions that have grown out of our pilot work on Soldiers who served in ODS/DS, and makes recommendations for the collection and management of data that will enhance future efforts of this nature.

THE TAIHOD AND ITS COMPONENT PARTS

The TAIHOD contains extensive information on demographic and occupational histories of active duty Army Soldiers, records of inpatient hospitalizations, deaths, disability board evaluations, and ambulatory care visits (see Figure 1). It also includes data from the Comprehensive Clinical Examination Program (CCEP) of Gulf War veterans, coded data and narrative accounts of mishaps reported to the U.S. Army Safety Center, and various health behavior surveys, including the Army Health Risk Appraisal (HRA), the Health Enrollment Assessment Review (HEAR), and several Defense Manpower Data Center (DMDC) Surveys of Active Duty Servicemembers. The TAIHOD has recently acquired free text comment fields for hospitalizations related to injury, and extracts from the Army Central Registry (ACR) of documented reports of spouse and child abuse. An ambitious process of scanning hard copy physical evaluation board (PEB) disability records and the concomitant development of an electronic indexing and retrieval system for these records will also provide substantial detail for the study of disability among Army Soldiers. A recent collaborative effort with the Veterans Administration (VA) also brought in VA utilization and cost information.

Figure 1. The Total Army Injury and Health Outcomes Database (TAIHOD)



Demographic and Occupational Data

Demographic and occupational data in the TAIHOD are received from the DMDC in Monterey, CA (http://www.dmdc.osd.mil). These files contain basic demographic information such as date of birth, gender, race, educational attainment, ethnicity, rank, unit, marital status, military occupational specialty (MOS), and total time in service, for active duty as well as Army Reserve and Army National Guard Soldiers. (A complete list of variables in each database is available upon request.) These demographic variables are useful for defining and describing populations particularly at risk for certain adverse health outcomes. In addition, population demographic data are necessary for calculating population-based rates of morbidity and mortality and for controlling for confounding. Personnel data were reported annually between 1971 and 1979, but have

been updated in the TAIHOD semiannually for the years 1980-2002. Since, June 1, 2002, personnel files have been updated monthly.

In addition to core demographic data, the DMDC supplies information on various types of special pay received (e.g., special pay received for exposure to hostile fire or for specific Army duties such as parachuting, flying, or diving). Finally, loss files from the DMDC allow precise determination of each servicemember's length of service, with dates of entry into and separation from military service and reason for separation from service (e.g., retirement, misconduct, disability).

Gulf War Activation Files

The Gulf War Activation files were created after ODS/DS, in a post-hoc effort by the services to determine the deployment status of individual Soldiers. The files, maintained by the DMDC, give specific dates in and out of theater. Many Gulf War health researchers use these files. As we will discuss later in this report, there is some uncertainty about the quality of information in these files. A validation study of these files is currently underway.

Inpatient Hospitalization Files

Data on inpatient hospitalizations have been obtained from the Individual Patient Data System (IPDS), maintained by the Patient Administration Systems and Biostatistics Activity (PASBA) (http://www.pasba.amedd.army.mil). The TAIHOD currently contains information on all active-duty Soldiers who were hospitalized while on active duty from 1971 forward. If an active-duty Soldier is treated in a civilian hospital, the hospital is required to submit records to the military in order to receive reimbursement, so many hospitalizations of active duty Army Soldiers in civilian hospitals are also captured. However, changes in the way hospital data and care were managed beginning in 1996 may have affected the completeness of record capture by PASBA. We are currently investigating the potential extent of lost hospital records and exploring other sources of data on hospitalizations.

Hospital records contain demographic variables, up to eight International Classification of Disease (ICD) codes (for primary and subordinate diagnoses), cause-of-injury codes defined by a North Atlantic Treaty Organization Standardization Agreement (STANAG) if applicable, up to eight procedure codes, and total number of bed days. During the period of follow-up covered by the TAIHOD hospitalization files, the Army used three different versions of the ICD. From 1971-1979, they used ICD-A-8, then ICD-9 from 1980-1986, and ICD-9-CM since 1986. It is unlikely that all Army Medical Treatment Facilities (MTFs) made these transitions on exactly the same date, so we have found it necessary to exercise caution when querying the database for counts of hospitalizations around the time these changes were implemented. Moreover, each new version of the ICD introduces new codes for newly described clinical entities. Later in this report we will describe our efforts to use these data to construct a single coherent trend-line of Gulf War Illness (GWI) over this period.

Army hospitalization data also include essential information regarding injuries. Civilian hospital systems use the ICD system of E-codes, but the military uses the STANAG 2050 system instead. Unlike civilian hospitalization systems, where coding of injury causes is often incomplete and varies dramatically from state to state (40), the military system achieves a much higher rate of reporting cause of injury (5, 7). Military hospital records for injury cases also contain a text field that describe the circumstances of the injury and may be useful in exploring injury events in greater detail. These narrative data were recently added to the TAIHOD and currently cover a period from 1990 to 1999.

In addition to detailed information regarding hospitalizations, the inpatient files also contain Carded for Record Only (CRO) records. Historically, these records were created in order to track resources used to care for patients who were never admitted to the hospital (e.g., patients who were dead on arrival [DOA], or who died in the emergency room [ER]) and to facilitate surveillance of events of unique importance or interest (e.g., sexual assaults). Until 1996, CRO records were required on *all* emergency room or DOA deaths. Thus, it was possible to obtain cause-of-injury and/or free-text descriptions of the cause of injury for these deaths. Unfortunately, with the advent of the Ambulatory Data System (ADS), these records were considered unnecessary, because all encounters in the emergency departments are captured by ADS. Because ADS does not record cause-of-injury information, however, it is no longer possible to ascertain cause-of-injury on DOA cases or ER deaths, at least not using hospital data.

CRO records were also used to record Physical Evaluation Board (PEB) actions resulting in discharge from service for disability. Approximately two-thirds of the Soldiers who have been discharged from the Army since 1971 due to disability have CRO records in the hospital database. These records are a useful complementary data source to Army disability agency records. (Disability records will be described in greater detail in the sections that follow.) It is not clear why the remaining third of disability cases are missing CRO records, except that some of them appear to be cases that were found "fit" by the disability evaluation board (i.e., the Soldier was returned to duty). Although they do not represent admissions, CRO records provide important information, such as ICD-9-CM codes (which are not present in the physical disability database) and cause-of-injury codes. Unfortunately, as for DOA and ER deaths, the use of the CRO records for tracking disability cases has been phased out, thereby eliminating this source of information on disability cases. The emergence of the Medical Evaluation Board Interim Tracking Tool (MEBBITT) in 1999, however, is a promising development, and will yield a more complete source of information for the study of disability.

Another complexity in the use of hospitalization data relates to changes in the overall management of care. In the mid- to late 1990s, the military began increasing outsourcing of cases to civilian facilities through TRICARE, the military's version of a managed care health plan for military servicemembers and their beneficiaries. Military reimbursement procedures had previously resulted in direct billing of care provided to an active duty servicemember to the MTF where care was provided. However, with the advent of TRICARE, some of these cases began being recorded elsewhere and are not

captured directly by PASBA's (IPDS). This change may result in underreporting hospitalizations after 1995. Of particular concern is that reporting may potentially vary by the type of condition or event (e.g., trauma, obstetric services) and potentially by location, especially in some areas that are served only by smaller MTFs, where a full complement of medical services may not be available. We expect to begin obtaining two additional databases that capture more of these outsourced cases in the future: the Civilian Health and Medical Program of the Uniformed Services and the Healthcare Services Record files. Further exploration will be needed to determine whether these databases, in combination with the IPDS, will capture all inpatient hospitalizations of active-duty Soldiers.

Finally, the TAIHOD includes records on special categories of patients. These include patients who use MTFs while on the Temporary Disability Retired List (TDRL). These patients are awaiting the results of a disability evaluation. (The disability records are described in greater detail in the sections that follow.) Another category includes "former active duty service members," such as women requesting discharges from the military under Chapter 8 (pregnancy). These patients are authorized to receive care in MTFs for a defined interval extending into the post-partum period.

Ambulatory Care Encounters

Through the ADS, PASBA has provided outpatient encounter records to the TAIHOD approximately twice a year since late 1997. These files contain up to four ICD-9-CM codes describing the reason for the encounter and up to four Current Procedural Terminology procedure codes. Data are now available for hundreds of thousands of outpatient encounters each year. Because the TAIHOD contains both diagnostic and procedure codes, we can evaluate the intensity of resource utilization, as well as severity of conditions. Unfortunately, STANAG cause-of-injury coding is not yet a feature of the ambulatory data collection system. However, in October 2000, the Department of Defense (DoD) approved plans to allow the use of ICD-9-CM E-codes in the ambulatory data. This will potentially allow cause of injury coding in the ADS without the necessity of major system changes to the ADS. However, the practical utility of this change cannot yet be evaluated because it depends upon providers to enter these additional codes, and it is not clear how completely providers will comply with this additional requirement. These data are expected to become more available as the Army's Composite Healthcare System (CHCS) is supplanted by CHCS-II, the new software to be used by providers in order to maintain electronic inpatient and outpatient data, and is fielded throughout the Military Health System.

Safety Center Data

The U.S. Army Safety Center receives reports on a portion of all unintentional injuries resulting in accidental death or serious injury, occupational illness, and property damage above certain thresholds (42) (https://safety.army.mil/home.html). Intentional injuries (e.g., homicide and suicide) and battle-related injuries are not included, nor are injuries that result in no lost time from work, or that incur neither lost time nor significant property damage. Safety Center data are updated in the TAIHOD annually for the years

1980-forward. The Safety Center data included in the TAIHOD comprise two parts: narrative accounts describing the circumstances under which the event occurred, and coded reports summarizing the event, both of which are completed by a representative of the injured Soldier's unit, or occasionally by a local safety office representative. The narrative reports may be as long as several pages or as short as several sentences; the level of detail is largely left up to the discretion of the individual completing the form. However, serious cases (e.g., those where a death occurred) almost always include a much greater level of detail than other cases, sometimes with several pages of accompanying text. Thus, there is a rich pool of data that could be used to better understand the nature and circumstances under which an injury event occurred. While substantial under-reporting is believed to be a characteristic of this database, its significant strength is the rich detail that is present on the cases that are reported, especially when linked to other databases.

Disability Data

The U.S. Army Physical Disability Evaluation process includes two review boards to evaluate a potentially disabled Soldier's medical status. The Medical Evaluation Board (MEB) assesses the degree of the Soldier's disability using medical standards (IAW AR 40-501), while the Physical Evaluation Board (PEB) assesses the impact of the disability on the Soldier's ability to perform his or her military duties (93) (https://www.perscom.army.mil/tagd/pda/pdapage.htm). These review boards may find a Soldier permanently disabled, or may find that he or she is fit to return to duty. If the Soldier's condition is temporary or unstable, the PEB may assign the Soldier to TDRL. (Such cases are re-evaluated at least every 18 months, and within 5 years must be given a final disposition.) Upon completion of the review process, the disabled Soldier may be retired permanently, or separated with or without severance pay. The TAIHOD includes all PEB records for the years 1981-forward, with information on dates of disability and the findings of the disability boards (including disability-rating percentages).

Interpreting disability data is particularly challenging because Soldiers placed on TDRL may remain in that status for up to 5 years before a final disposition is reached. Once defined as a TDRL case, the Soldier may later be found fit for duty, remain as a TDRL case, or be retired with or without a disability rating. Some of these individuals never return for re-evaluation, they just let their benefits run out and neither return to duty nor become permanently retired. The database contains multiple records pertaining to continuing evaluations, which reflect changes in the Soldier's disability status. Additionally, the PEB data do not include ICD-9-CM codes for medical conditions and, instead, use a less specific system known as the Veterans Administration System for Rating Disability.

MEB data from the Medical Evaluation Interim Tracking Tool (MEBBITT) were added to the TAIHOD in 2002. These data are available electronically only since 1999 The particular strengths of these data are that they allow ascertainment of cases at an earlier point in the disability rating process than the PEB database (MEBs always precede PEBs), and more individuals meet MEBs than PEBs, making more cases

available for study in the MEB database. Perhaps most importantly, MEB records contain ICD-9-CM diagnostic codes.

Several years ago, the TAIHOD data management team conducted a pilot project to obtain and scan a sample of 300 complete disability records (PEB) from 1997. The purpose of this project was to determine whether scanned images of these hard copy records could be indexed for later retrieval. Although time consuming, this pilot process was successful and has led to a larger effort to scan records from 1998-2000. The TAIHOD currently has some limited ability to retrieve text data and, in the future, is expected to have more extensive capabilities to retrieve narrative text (uncoded) information from the disability records based on some predetermined criteria (e.g., deployment status) so that the complete record may be reviewed. Disability records contain narrative summaries that are dictated by physicians, with extensive detail on the history of the present illness, past medical history, social history, and physical exam findings. The narrative accounts in the disability records are more voluminous in the level of detail they provide and are more structured than the narrative accounts available in hospital-based records. Narrative data have been useful to TAIHOD researchers and others in the study of a wide range of injury and disability outcomes (4, 24, 59, 74, 109). The potential of these data in furthering an understanding of natural history of injury and disability is therefore significant. We have since obtained more than 25,000 disability records from CY 1998-2000 and are gradually scanning them into the database (~4,000 to date). We recently came to an agreement with the Army Enlisted Records Center (EREC) and the U.S. Army Physical Disability Agency (USAPDA) to have these records scanned at EREC, including the remainder of the hard copy records maintained at the disability agency. Hard copy records for 2001 through October 2003 are still maintained by the USAPDA, though the agency began digitizing its files in October of 2003. Future enhancements using these scanned PEB files may include application of Optical Character Recognition (OCR) to eventually allow electronic analysis of the text contained in these documents. Pilot testing of OCR on the narrative summaries within these records looks particularly promising. We hope these efforts will form the foundation for comprehensive study of one of the most costly medical outcomes among Army Soldiers, that is, permanent disability. An Army STO to examine long-term health outcomes is now in the proposal stage.

Comprehensive Clinical Evaluation Program (CCEP)

In response to the concerns of Gulf War veterans that their service in the war had compromised their health, the DoD implemented the CCEP registry in 1994 for Soldiers still on active duty (66) (http://deploymentlink.osd.mil/faq/faq_ccep.shtml). (Veterans who had served in the Gulf War were eligible for health evaluations through the Veteran's Administration Persian Gulf Registry). Registry in the CCEP was voluntary, and included a clinical examination and survey of self-reported exposures to putative risk factors, such as pesticides, oil-well fire smoke, and vaccines and other prophylactic agents. The CCEP data include extensive information about the health of Soldiers who registered with this program. The clinical examination resulted in ICD-9-CM coded diagnoses for each participating servicemember. In many cases the diagnosis was "healthy," because servicemembers were encouraged to register if they deployed to the

Gulf, even if they did not yet have any symptoms. Many of the items on these surveys have potential utility for the pursuit of research questions unrelated to their initial purpose (e.g., data on tobacco use), and it is therefore possible that the CCEP data will be useful for a variety of studies of Soldier health.

Health Risk Appraisal (HRA)

The U.S. Army began offering the HRA in 1987 as part of a comprehensive health promotion program. While a precursor HRA survey that focused on cardiovascular health was also administered through the mid- and late 1980s, we have only been able to locate HRAs from ~1990 forward. The 1990 and 1992 versions of the HRA questionnaire include 75 items (see Appendix B, DA Form 5675, 1 February, 1992) . Items 1-14 record basic demographic and administrative information (such as rank, branch of service, duty status, and unique identifying information such as name and SSN). Items 15-17 include self-reported anthropometric information on height, weight, and frame size. Items 70-75 gather clinical information (e.g., blood pressure, lipid levels, fasting glucose). The remaining items (items 18-69) form the core of the HRA and ask about health behaviors. Although HRAs are designed as educational and diagnostic tools and not to gather information for research purposes, the Army's HRA program, nonetheless, has yielded an enormous database of self-reported information about health habits that has proven quite useful for research purposes (23, 25, 27, 35, 47, 49, 83, 94, 98, 119, 124, 129). The Army's HRA includes a date field, allowing for the study of temporal associations between self-reported health habits and health outcomes. Moreover, a large number of Soldiers took the HRA more than once, allowing for the evaluation of changes in self-reported health behaviors, and an assessment of how these behavior changes may impact health. The TAIHOD maintains two separate databases of HRA data. The primary file contains HRA survey data taken by people who said they were active duty Army at the time they took the survey. The secondary file contains survey data of respondents without regard to how they described their service and military branch. All survey takers were matched to the DMDC personnel files, so all were active duty at some point, but not necessarily at the time they took the HRA.

These data have some limitations. First, the mechanism of administration was not entirely random. Soldiers who are young, single, and with a short time in active duty service are slightly over-represented among HRA takers. This is most likely the result of the administration process. The most common reason for taking an HRA is through in-processing to the military or a new assignment (27). Despite not being randomly distributed, differences between HRA takers and non-takers are very small.

Second, the health promotion program was implemented throughout the DoD, and retirees, dependent family members, and civilian employees sometimes also took the HRA. Dependent family members of military servicemembers are often required to use the servicemember's SSN to access military benefits, especially military medical benefits such as the HRA. It is therefore sometimes difficult to firmly establish whether the surveys being evaluated are those of an active duty servicemember, or those of a civilian employee, retiree, or family member. There are questions on the survey that

ask the respondent to identify himself as child, spouse, retiree, civilian employee, or active duty service member. However, these categories are not mutually exclusive and, where there was ambiguity, we resorted to comparing age and gender as reported on the HRA with age and gender on the DMDC personnel file.

Third, the HRA form in use during the time period for which data were archived was revised at least twice. (DA Form 5675 was originally issued in May 1988, then underwent a major revision in October 1990, and a much less substantial revision in 1992.) It is not known what instructions were given to people running the HRA at the installation level, but it is likely that existing supplies of forms may have been used before the newer versions were fully distributed. Unfortunately, the HRA database does not include a code indicating which version of the form the respondent was using. The 1988 version is so different from the 1990 and 1992 versions that data from that survey would not likely be mistaken with the other versions. Furthermore, no data we have been able to find appears to be derived from the 1988 version of the survey.

Fourth, we have found no evidence that the Army undertook any systematic efforts to assess the reliability and validity of responses to these questions. A technical report documenting what is known about the pedigree of the items on the HRA, and reviewing what is known about their reliability and validity in other contexts provides greater detail on these issues (105). An additional paper focuses on validation of the questions on the HRA that pertain to alcohol consumption (27).

Fifth, the HRA database contains a number of duplicate and near duplicate records. This may have occurred when a technician or health screener inadvertently or intentionally ran surveys through the scanning machine more than once if he or she thought the first survey did not register properly. It may also have occurred if, after scanning the document, the health assessment official noted missing items and asked the respondent to add more information before rescanning the survey. While it is easy to identify these records, it is not always possible to know which record should be kept from among a set of near duplicate records.

Sixth, the HRA survey program was designed to have the computer automatically add a date and time stamp to each survey datafile. Anecdotal evidence suggests that in early years of the HRA program, many computers used to process HRA surveys required manual updates of the date and time fields. It is likely that this effort was not uniformly applied across all Army computers resulting in unreliable dates for at least the first years of the program. Our own analysis and attempts to validate dates by cross-referencing with the respondents stated age and our demographic information on the respondents date of birth suggest that all surveys in the TAIHOD with dates preceding 1990 are probably not correctly dated.

The HRA remains an important source of useful information on health behaviors and risk factors, but depending on the question under investigation, investigators should use caution in analyzing HRA responses.

Health Enrollment Assessment Review (HEAR)

The HEAR is a self-reported survey examining health habits and utilization of the health care system (http://www.mgmc.af.mil/3rd/hear_PPIP.html). The HEAR replaced the HRA in 1998 and is to be administered to all members, ages 17 and older, of TRICARE Prime, the military health maintenance organization. Like the HRA, it queries respondents about health habits and behaviors, but unlike the HRA, its primary purpose is not health promotion or education. Its purpose is to identify patients who need preventive health care services, or who might benefit from counseling or health promotion interventions, and to predict the level of primary care a member will require. Its method of administration is also different; it was administered in its first several years by mail, but is being developed for administration via an interactive computer tutorial that will link the patient information directly to CHCS II. Although we have begun merging available 1998 and 1999 HEAR survey data (N = 43,377 surveys) with the TAIHOD, the HEAR has not yet been extensively evaluated with regard to data quality and sample representation. Because these surveys are administered and maintained by TRICARE region, there is still no single, central repository or site where all data are maintained and thereby easily accessed for research purposes. Since the regional TRICARE contracts to collect HEAR data have all recently ended, it is anticipated that all HEAR surveys collected to date may soon be consolidated and potentially available for study.

DMDC Survey of Active Duty Servicemembers

These surveys were administered to a statistically weighted random sample of military servicemembers in 1985, 1992, and 1999. They were originally developed in order to identify the changing needs of servicemembers and to guide the development of new policies. They cover a broad range of issues such as satisfaction with the military lifestyle, deployments, retention and career initiatives, dependent and childcare issues, military compensation, benefits and programs, and family resources. Of particular relevance to our research are several items within each of these categories that assess satisfaction with these various aspects of military life and capture information on associated levels of stress and distress. The 1992 version of this survey contains an item asking respondents if they were deployed to Operations Desert Shield/Desert Storm (ODS/DS) and is being used in a study to validate Gulf War deployment files.

Army Casualty Information Processing System (ACIPS) Directorate for Information Operations and Reports (DIOR), and the Armed Forces Institute of Pathology (AFIP) Death Registry

The Army's casualty database contains information on all fatalities occurring to active duty service personnel, whether job-related or not. They are obtained from the Report of Casualty form (DoD Form 1300), which is an abridged form of the civilian death certificate (http://www.defenselink.mil/privacy/notices/army/A0600-8-1c_AHRC.html, http://web1.whs.osd.mil/DIORHOME.HTM) The form includes deaths from both disease and injuries; the TAIHOD includes all records of such deaths from

1980 forward. However, it does not always include information regarding the specific external cause of death. A standardized extract of these data containing a limited number of fields is transmitted to the DIOR from each of the military services. ACIPS data were obtained for a limited time period in the mid-1990s and generally includes more information than the DIOR data, including several free text fields that may indicate details about activity and cause of injury. However, difficulties in obtaining the data directly from the Army Casualty Center and the recent addition of text fields to the DIOR may eliminate any future need to obtain data from ACIPS directly. Substantial data on deaths (including ICD-9-CM codes and cause-of-injury codes) may also be available by linking casualty reports to hospital CRO records or Safety Center accident reports. Hospital free-text data and Safety Center narratives can then be used to glean contextual details about the circumstances of the death. Another positive development is the recently established Armed Forces Institute of Pathology (http://www.afip.org/Departments/repository/index.html) (51) registry for active duty deaths. The registry will provide more accurate cause of death data because it will be collected from multiple sources including autopsies.

Defense Occupational and Environmental Health Readiness System (DOEHRS)

The Defense Occupational and Environmental Health Readiness System (DOEHRS) – formerly the Defense Occupational Health Readiness System – is the data warehouse devoted to documentation of environmental exposures such as noise, air quality, and various industrial chemicals. DOEHRS also contains serial audiograms collected through the Army Hearing Conservation Program (https://dohrswww.apgea.army.mil/dohrsdr/).

Since the early 1980s, audiometric measures have been taken on more than 1 million individuals. Most Soldiers receive a baseline audiometry screening (documented in DD Form 2215) upon entry into the Army and are screened again upon leaving the service. Soldiers in units with high potential for noise exposure also receive annual hearing loss screening tests. Any changes from baseline or noted loss of function are reported on DD Form 2216. Data from both forms are entered in a database, and the information is then stored at the DOEHRS. Approximately 250,000 to 300,000 audiometry screenings (i.e., recent inductees and annual screenings) are recorded each year.

Additionally, hundreds of worksite noise and chemical exposure levels have been collected providing ecological data useful for estimating noise and chemical exposure levels for various Army occupational groups. Individual measurements are also available for many active duty Army personnel. The TAIHOD team has used them in one study examining the relationship of exposure to organic compounds and breast cancer (97). These data have not been updated nor used extensively by the TAIHOD research team, but could be, if needed.

Army Central Registry Child/Spouse Abuse Reporting System (ACR)

The Army Family Advocacy Program investigates, reports, and treats cases of abuse and neglect among family members of active duty Soldiers. A confidential registry of these cases has been maintained through the Army Central Registry (ACR) since 1975 (http://www.army.mil/usapa/epubs/pdf/r608_18.pdf)

(http://www.armycommunityservice.org/vacs_advocacy/home.asp) (84) Data include information about the victim and the offender, such as the nature and severity of the abuse, gender, date of birth, and race. In addition, the data state how the case was investigated, what steps were undertaken to resolve the problem, and the agency that provided the intervention. Cases are coded as one of five possible categories, including neglect, minor physical abuse, major physical abuse, sexual abuse, or emotional abuse. These data are the central focus of a grant from the National Institute on Alcohol Abuse and Alcoholism to study the relationship of alcohol use and spousal violence among Army Soldiers. They also have the potential to shed light on the influence of deployment-related stressors and subsequent risk of family violence in the post-deployment period.

Aviation Epidemiology Data Registry (AEDR)

The Aviation Epidemiology Data Repository (AEDR) is a family of independent databases maintained by the U.S. Army Aeromedical Research Laboratory (USAARL) (http://www.usaarl.army.mil/) and the U.S. Army Aeromedical Activity (http://usasam.amedd.army.mil/_AAMA/mission.htm), both at Ft. Rucker, AL. One such component of the AEDR is a centralized database of history and physical findings from Army Flying Duty Medical Exams. These history and physical findings are used primarily to track trends in aviation medicine and also provide historical data such as waivers to standard medical qualifications. The history and physical exam data available from these annual exams is extensive. Because most aviators are required to have exams annually, serial exams are available on thousands of individuals. We received AEDR data for the first time in 2003. Because aviators are an important occupational group in the Army and because they face unique, often hazardous duty exposures, the addition of the AEDR strengthens the TAIHOD considerably as a tool for force health protection research.

Airborne Jump School Data

Airborne school roster data represent one of the few primary data collection efforts the TAIHOD team has pursued. The airborne school did not always maintain electronic records of individuals entering or completing Basic Airborne School (http://usmilitary.about.com/gi/dynamic/offsite.htm?site=http://www.benning.army.mil/airborne/airborne/index.htm). Several years ago, we came to an agreement with the Infantry School at Fort Benning to scan the paper rosters they had in their library going back as far as 1985. We then contracted to have the SSNs of these individuals entered into an electronic database so that we could study this population. Since 1985, over 225,000 individuals have enrolled in the Airborne school. Close to 1 million parachute jumps have been made over this 20-year period, making this the both the largest database of its kind and possibly the only such large database that is capable of

tracking characteristics and risk factors at the level of the individual. The fact that nearly all medical care for these individuals is issued at a single troop medical clinic or a single MTF (Martin Army Community Hospital) at Fort Benning makes it possible to do many unique and powerful analyses. The first such study compares injury hospitalization rates during intervals when parachute ankle braces were in use versus periods when they were not (104) (103). Additional studies underway will specifically compare injuries and other medical outcomes between women and men during this demanding training. Additional studies of the influence of Airborne training on various medical outcomes, career success, or other factors are also possible.

Center for Unit Records Research (CURR)

This database comes from the DoD Persian Gulf Registry. It consists of two files. The first is a personnel file consisting of Soldiers who were deployed to the Gulf between January of 1990 and March of 1992. The second is a unit movement file. The Persian Gulf registry personnel file is linked to the Army unit movement file by unit Identification Code. The personnel file contains many of the same variables found in the DMDC personnel files, in addition to “in theater” start date, and in theater end date. The unit movement file contains latitude and longitude, the date the location was reported, and a place name.

Anthrax Vaccination Data

The Defense Department’s Anthrax Vaccination Immunization Program is vital to the safety of U.S. military personnel. Since the inception of the program in March of 1998, more than 1,000,000 personnel have received at least one vaccination (up to a maximum of six). In the recent past, despite substantial evidence of the vaccine’s relative safety, questions have been raised and allegations made linking anthrax vaccination with a host of medical conditions. Several studies complete or underway are addressing these concerns. The TAIHOD was perhaps the only database that already had linkable data across the whole health care spectrum, including disability discharge. In November 2000 the Army Office of the Surgeon General asked the TAIHOD team to design and conduct a study to look for associations between anthrax immunization and disability discharge.

The TAIHOD was commissioned to undertake a study with the specific objective of examining whether U.S. Army personnel receiving one or more doses of Anthrax Vaccine Adsorbed (AVA) between March 1998 and February 2002 were at higher risk of disability than comparable personnel who were not vaccinated against anthrax. An historical cohort study of 716,833 active-duty Army personnel (154,456 vaccinated with AVA) was followed over 4.25 years to determine rates of evaluation for disability discharge. Cox proportional hazards models estimated the risk of evaluation for disability, comparing vaccinated with unvaccinated persons and accounting for occupational and sociodemographic characteristics that might be determinants of vaccination, risk of disability, or both. After adjustment for demographic and occupational characteristics, the overall hazard ratio (HR) was 0.96 (95% CI: 0.92, 0.99). Gender-specific adjusted HRs were 0.96 (95% CI: 0.92, 1.0) for men, and 1.04

(95% CI: 0.96, 1.13) for women. Separate adjusted HRs for permanent and temporary disability discharge, and for disability due to musculoskeletal and neurological conditions, were comparable to HRs for all disability evaluations, ranging from 0.90 to 1.04. The adjusted HR for disability evaluation was essentially unchanged when various latency assumptions were introduced into the model. This effort resulted in the conclusion that Army personnel vaccinated against anthrax are not at increased risk of disability, though that finding may be partially due to factors influencing selection for vaccination (115).

The Drug and Alcohol Management Information System (DAMIS) Database

In the fall of 2003 we acquired and began linking data from the DAMIS. This system, which operates under the Army's Substance Abuse and Prevention (ASAP) program, collects and reports data on the magnitude of drug and alcohol problems based on random and routine urine screening, as well as referrals for alcohol and drug treatment (self, command, or medical referrals). Local ASAP programs around the world complete standard reports (DA3711, DA4465, and DA4466) documenting positive drug and alcohol screens, referrals, and patient follow-up/progress. These records are linked to TAIHOD data in order to enhance information already available on alcohol use and abuse. The presence of these data in concert with extensive outcomes data, several sources of self-reported alcohol use, and abuse data (i.e., HRA) make the TAIHOD perhaps one of the most comprehensive sources for the study of the relationship between alcohol use and health outcomes.

CHAPTER 2: FORCE HEALTH PROTECTION FINDINGS

In this chapter we highlight some of the important findings related to Force Health Protection. The key findings are divided into sub-topics: Outcomes and Risk Factors. In addition, we identify and discuss strengths and weaknesses of the TAIHOD component databases as tools for Force Health Protection research.

HEALTH OUTCOMES

We have thus far used the following data sources on health outcomes in our research on deployment-related illnesses: inpatient hospitalizations, outpatient encounters, and registration with the CCEP. The TAIHOD also holds promise for the study of deployment-related deaths, disabilities, and injury morbidity, although it has not yet been fully exploited in the study of these conditions with respect to their association with deployment. We have used other databases contained in the TAIHOD for research important to the health and well-being of active duty Soldiers, but not specifically designed to address questions pertaining to deployment-health.

Hospitalizations

Because the TAIHOD includes data on deployment to ODS/DS and comprehensive hospitalization data, it is possible to compare the hospitalization histories of deployed and non-deployed GWE veterans both before and after the conflict. In addition, hospital data present in the TAIHOD extend from 1971 through the present allowing for the analysis of long-term trends in the "background rate" of hospitalizations common among Soldiers deployed to the Gulf.

While hospitalizations provide some of the most complete information we have about the health experiences of deployed veterans, they are not without limitations. Hospitalization databases are notoriously unreliable for capturing information on symptoms or poorly defined conditions that are diagnosed by clinical, rather than more empirical methods (e.g., fibromyalgia). Yet, many Soldiers who sought care presented these types of ill-defined, symptom-based conditions upon returning from ODS/DS (45, 48, 50, 57, 64, 72). Researchers have thus had to rely on proxy measures (e.g., defining cases as hospitalizations for an ICD-9-CM coded ill-defined condition) to measure health outcomes among deployed GWE veterans. Unfortunately, hospitalizations for ill-defined conditions are not very sensitive or specific indicators of these relatively minor, though chronic and potentially debilitating conditions.

In addition, hospitalization data may be a biased measure of baseline health, which may further limit their use in the study of the health of Gulf War veterans. We have found evidence of bias in at least four areas: (1) changes in the way in which conditions are assigned diagnoses, and in the way health care is delivered in general (e.g., temporal trends in hospitalization admission rates); (2) instrumentation bias (i.e., variable sensitivity of hospitalization for different diagnoses); (3) historical bias (e.g., associations between hospitalizations and events external to the war, such as media coverage of GWI and military downsizing); and (4) healthy worker effect (i.e., a greater

attrition rate among war veterans and VA care-seeking for previously unreported war-related health concerns). It should be noted that these biases are not limited to the TAIHOD and are a potential limitation to any study of GWE veteran's health that relies solely on hospitalization data. These potential biases have not been well documented in the literature, as they pertain to the use of administrative data sources and, in fact, are often ignored by researchers using administrative data in epidemiologic research. One of our goals has been to highlight these data limitations and to point out the potential influence of these sources of bias on research outcomes.

Some of our earliest work on health risks to Soldiers deployed during ODS/DS included an effort to document trends in hospitalizations for the 25 most common diagnoses (other than "healthy") among Gulf War veterans registered with the CCEP. We conducted this analysis over nearly three decades (1971-1998) to determine what the "background rate" of these conditions was among active-duty Army Soldiers prior to, during, and after the war. Because we were interested in comparative health we examined rates among Soldiers who were and who were not deployed to the Gulf. This analysis was possible only because the TAIHOD included hospitalization records spanning a long time period, but was challenging for many reasons. First, the Army used three different versions of the ICD classification system during the period of follow-up. Some of the conditions common among GWE veterans (e.g., post-traumatic stress disorder) did not exist in the ICD prior to Version 9 (see Table 1). Second, hospital admission practices have changed over time, and coding practices have evolved based on new research and medical guidelines. Finally, there have been changes in the way that medical care is delivered and how and where some hospitalization data are captured. Cost containment pressures have resulted in a system of managed care that tends to limit access to medical care providers and that favors treating patients on an outpatient basis in order to avoid costly hospitalizations altogether. To address changes occurring between versions of the ICD, we contracted with an expert nosologist to derive equivalent codes across the three different versions of the ICD in use by the Army during the follow-up period (ICDA8, ICD-9, and ICD-9-CM). For comparison purposes, we also plotted rates for appendicitis (ICD codes 540-543.99) as an example of a well-defined clinical condition whose code did not change over the study period. Appendicitis has consistently required at least a one-night hospitalization, and therefore would be expected to be unaffected by cost-containment pressures that may have resulted in many other patients being managed in an outpatient setting.

Table 1. Twenty-Five Conditions (Other Than "Healthy") Most Commonly Reported by Active-Duty Army Soldiers Registering with the Comprehensive Clinical Evaluation Program (CCEP), with Their ICD-9-CM Codes and Corresponding Codes from the ICD-9 and ICDA8 Code Books

ICD-9-CM	% of Diagnoses	ICD-9-CM DEFINITION	ICD-9	ICDA8
290-319		**Mental Disorders**		
296.20	8.5%	Major depressive disorder, unspecified	296.1	296.0, 296.2
300.4	4.4%	Neurotic depression	300.4	300.0, 300.4
307.81	1.9%	Tension headache	307.8	306.8
309.81	1.9%	Prolonged post-traumatic stress disorder	N/A	N/A
311	7.4%	Depressive disorder, not elsewhere classified	311	790.2
320-389		**Diseases of the Nervous System & Sense Organs**		
346.90	2.0%	Migraine, unspecified	346.9	346
390-459		**Diseases of the Circulatory System**		
401.9	5.6%	Essential hypertension, unspecified	401.9	401
460-519		**Diseases of the Respiratory System**		
477.9	0.5%	Allergic rhinitis, cause unspecified	477.9	507
493.90	16.5%	Asthma, unspecified, without mention of status asthmaticus	493.90	305.2, 490, 493
520-579		**Diseases of the Digestive System**		
530.81	3.3%	Esophageal reflux	530.0, 530.1	530.9
564.1	2.9%	Irritable colon	564.1	305.5, 564.1
680-709		**Diseases of the Skin and Subcutaneous Tissue**		
692.9	1.5%	Contact dermatitis and other eczema, unspecified cause	692.9	692.9
710-739		**Diseases of the Musculoskeletal System and Connective Tissue**		
715.18	0.1%	Osteoarthritis, localized, other specified sites	715.18	N/A
715.90	0.5%	Osteoarthritis, unspecified, multiple sites	715.90	713.0, 723.9
719.40	0.2%	Pain in joint, site unspecified	719.40	787.3
719.46	7.9%	Pain in joint, lower leg	719.46	N/A
719.49	0.3%	Pain in joint, multiple sites	719.49	787.3
724.2	22.9%	Lumbago	724.2, 724.9	717.0, 717.9, 728.7
729.1	2.4%	Myalgia and myositis, unspecified	729.19	717.9, 733.9
780-799		**Symptoms, Signs and Ill-Defined Conditions**		
780.52	0.2%	Other insomnia	780.5	306.4
780.57	1.2%	Other and unspecified sleep apnea	N/A	N/A
780.7	1.0%	Malaise and fatigue	300.5, 780.7	300.5, 309.1, 790.1, 796.0
780.9	0.6%	Other general symptoms	300.9, 780.9	300.9, 780.7, 781.6, 788.9, 790.2
782.1	0.6%	Rash and other non-specific skin eruption	782.1	788.2
784.0	6.0%	Headache	784.0	791

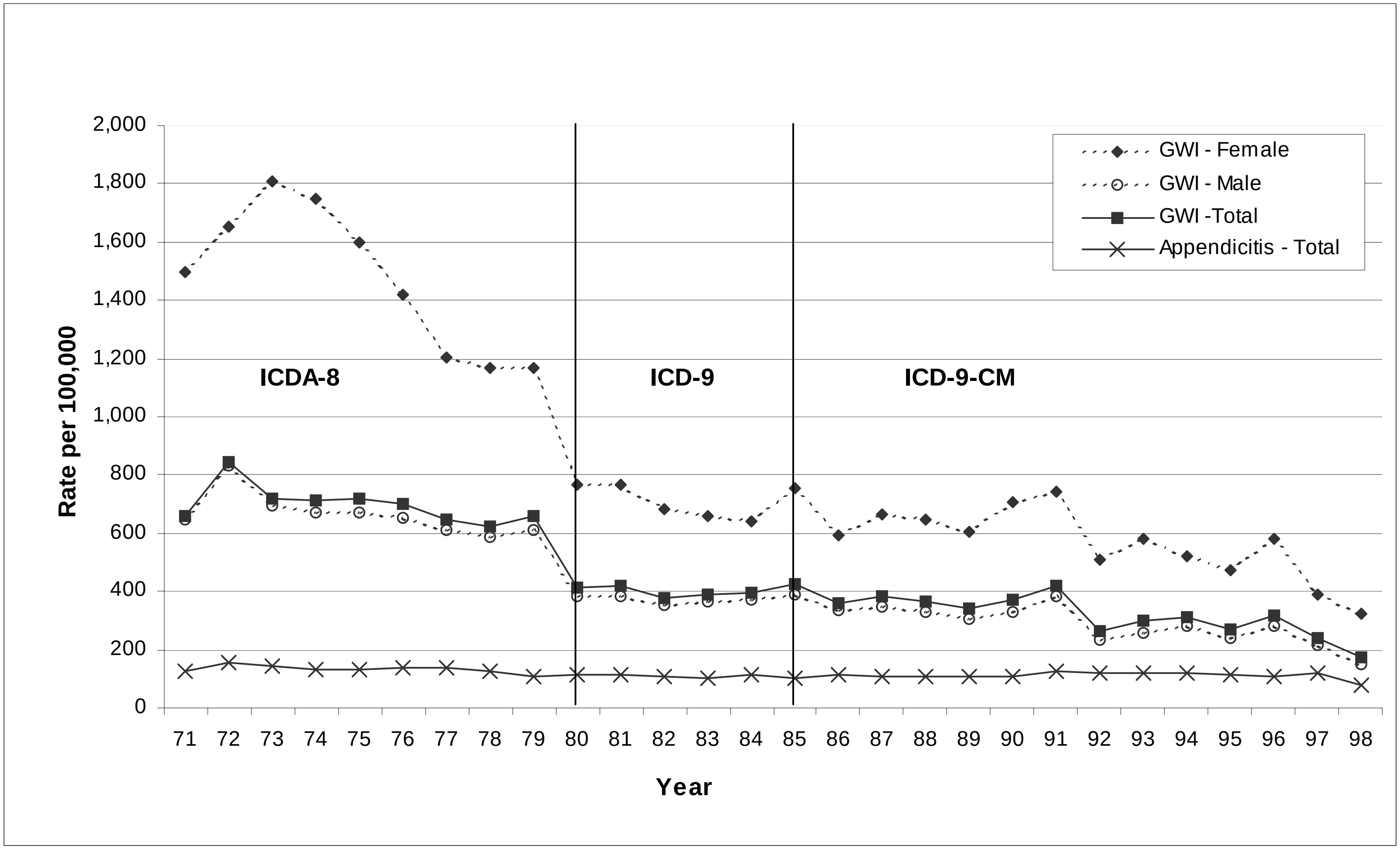
N/A=No prior code is applicable.

Figure 2 shows hospitalization rates for disorders common among CCEP registrants, as well as appendicitis rates (all active duty Army Soldiers, 1971-1998). The chart clearly demonstrates some of the technical challenges involved in a temporal analysis of this sort. As expected, hospitalization rates for appendicitis have remained fairly stable across the entire time period. Hospitalizations for conditions common among GW veterans registered with CCEP have declined over time from 658/100,000 in 1971 to 176/100,000 in 1998. While hospitalization rates overall appear to have declined, there were notable peaks in rates of these disorders in the early 1970s, and again just after the Gulf War in 1991. There were also several smaller increases in rates, generally preceding each major version change in the ICD. This suggests that changes in coding could affect analysis of temporal data, and researchers using hospital data for trend analysis need to be cognizant of this issue.

It is also noteworthy that although military tacticians and researchers have expressed concern that the exponential increase in the number and types of deployments during the 1990s may result in excess morbidity among deployed Soldiers, this chart suggests that rates for those conditions most common among deployed Gulf War veterans either did not increase dramatically during this time period, or were not captured by hospitalization databases. It may be that there was no increase in rates for these conditions among Soldiers involved in other deployments after ODS/DS. On the other hand, it might reflect the fact that other deployments after the ODS/DS were too small to have had a meaningful impact on Army hospitalization rates for these conditions. Additionally, hospitalizations may be insensitive indicators of the health problems associated with deployment. Changes in recent hospitalization admission practices or incomplete capture of the data make them inadequate, at the present time, for analyses of this sort.

Our efforts to map trends in GWI over a 30-year period reflect both the strengths and limitations of this type of research. The manner in which we identified codes in prior editions of the ICD may have introduced some misclassification, especially when some conditions were grouped or ungrouped in different versions of the ICD, or when codes were introduced for “new” conditions. For example, post-traumatic stress disorder (PTSD) had no formal code or definition prior to ICD-9. The exclusion of this condition from the combined list of top 25 CCEP diagnoses may have biased the overall hospitalization rates downward in the early years of the chart. In contrast, in other cases, conditions with unique codes under ICD-9 were grouped with other codes under ICDA8 because they could not be disentangled. This may have resulted in an upward bias in rates for earlier years. While we made an effort to account for coding changes, it is most conservative to make comparisons within time periods that are covered by the same coding system. Thus, while we can conclude that overall rates were declining over time by examining downward trends that occurred during each of the three intervals covered by the different ICD versions, an absolute comparison between rates in 1971 and 1998 would be inadvisable.

Figure 2. Hospitalization rates for common disorders among CCEP registrants, and appendicitis among all active-duty Army Soldiers, 1971-1998



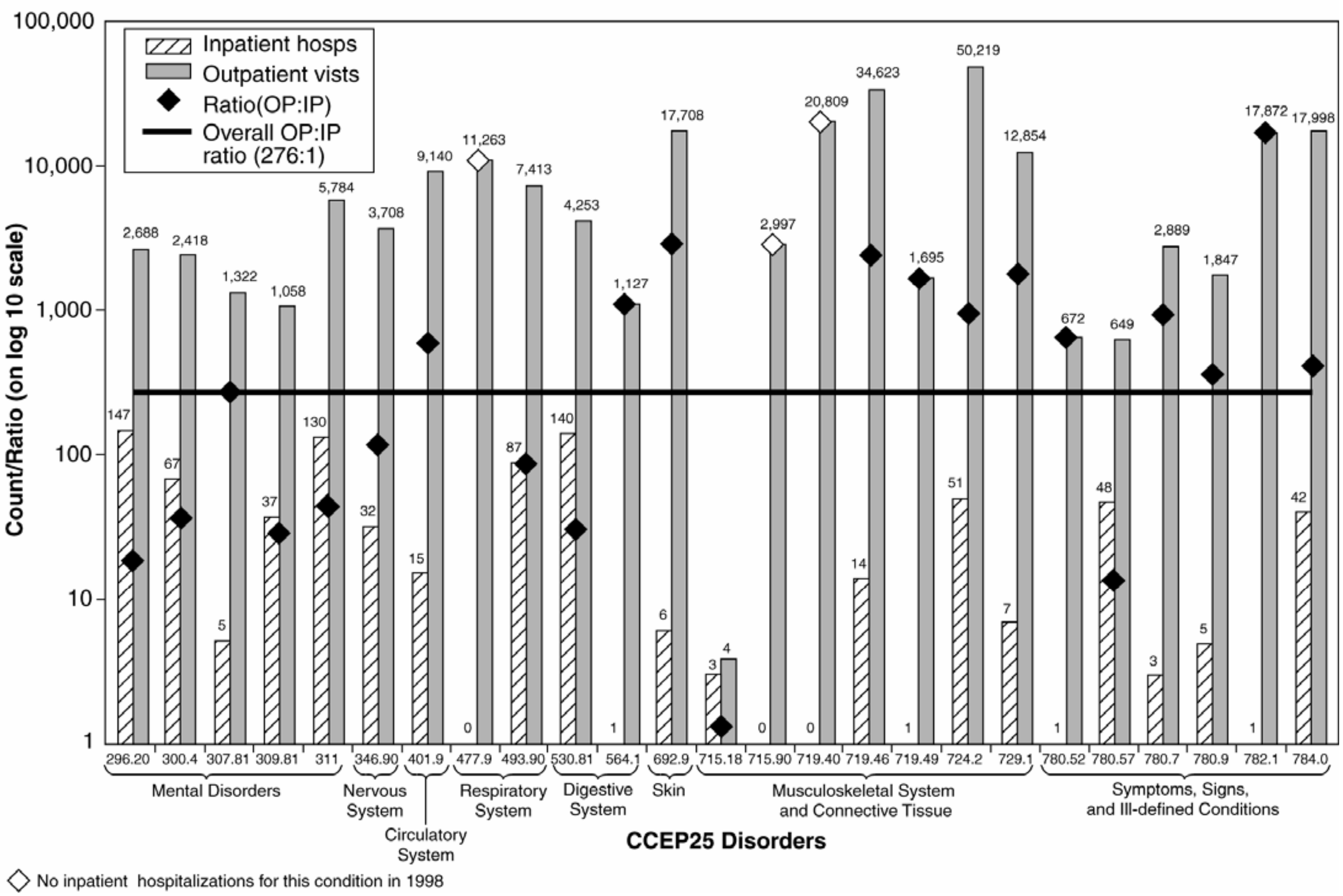
Outpatient Visits

We have begun exploring outpatient data as a tool for evaluating the influence of deployment on health. In fact, the symptom-based conditions that plagued many deployed GWE veterans are disabling, yet typically less than life threatening, and thus were often treated in outpatient settings such as clinics or physician's offices. However, electronic information on outpatient encounters was not available until late 1997, and we were therefore limited in our ability to fully examine the outpatient utilization histories for Gulf War veterans in the immediate post-war era. This is a significant limitation not only for researchers using the TAIHOD, but also for other researchers in this field. Many other published studies have therefore focused instead on the only consistently available data spanning the critical time period: inpatient hospitalizations (23, 53, 56, 70, 73). In addition to problems exploring hospitalization trends that were described above, there are other limitations relevant to the decision to use hospitalizations as a proxy for all morbidity.

If the cases that resulted in hospitalization for both deployed and non-deployed GWE veterans were those that were most severe regardless of diagnosis, then using hospitalizations alone as a proxy measure for all such conditions might result in a realistic picture of the overall condition-specific morbidity among GWE veterans. If, however, some conditions were more likely to result in hospitalization regardless of severity, then the resulting picture of morbidity among deployed GWE veterans is likely to be skewed toward these conditions. Most troubling is the possibility that certain conditions may be more likely to result in hospitalization based on a Soldier's deployment status (e.g., deployed versus non-deployed), branch of service (e.g., Army versus Navy), duty status (e.g., active duty, Guard, or Reserve), or time spent in the Gulf (e.g., dates or duration of deployment).

Our research suggests, in fact, that hospitalizations do not provide a very good representation of all types of morbidity among deployed GWE veterans. In our comparison of inpatient and outpatient rates for conditions common among deployed GWE veterans for calendar year 1998 (the first full year for which data on outpatient encounters are available in electronic format), we found that ratios of hospitalizations to ambulatory care visits varied markedly by condition (see Figure 3). Using hospitalization data alone to quantify symptom-based illnesses is likely to undercount all conditions, and to do so in different proportions for certain individual diagnoses and broad diagnostic categories. Therefore, hospitalization data may be very powerful in detecting increases in some conditions (e.g., psychiatric disorders) while overlooking others (e.g., musculoskeletal conditions). This might lead researchers to undervalue the true burden of morbidity presented by certain conditions, or to overestimate the relative contributions toward morbidity from other conditions.

Figure 3. Number of inpatient hospitalizations and outpatient encounters for top 25 CCEP disorders, with ratio of outpatient to inpatient encounters, all active-duty Army Soldiers, 1998



This limitation of the TAIHOD with regard to studies of post-deployment health will become less relevant with the investigation of more recent deployments, as outpatient data have been available in electronic form since 1998. Despite the availability of better outpatient data, however, researchers must remember that comparisons between inpatient and outpatient rates will necessarily be incomplete unless all inpatient encounters from all outsourced facilities (e.g., TRICARE) and all outpatient encounters (such as Battalion Aid Stations) are captured. Moreover, ICD-10-CM will be coming on-line eventually, which means that researchers will need to wrestle yet again with changes in coding systems and changes in medical practices.

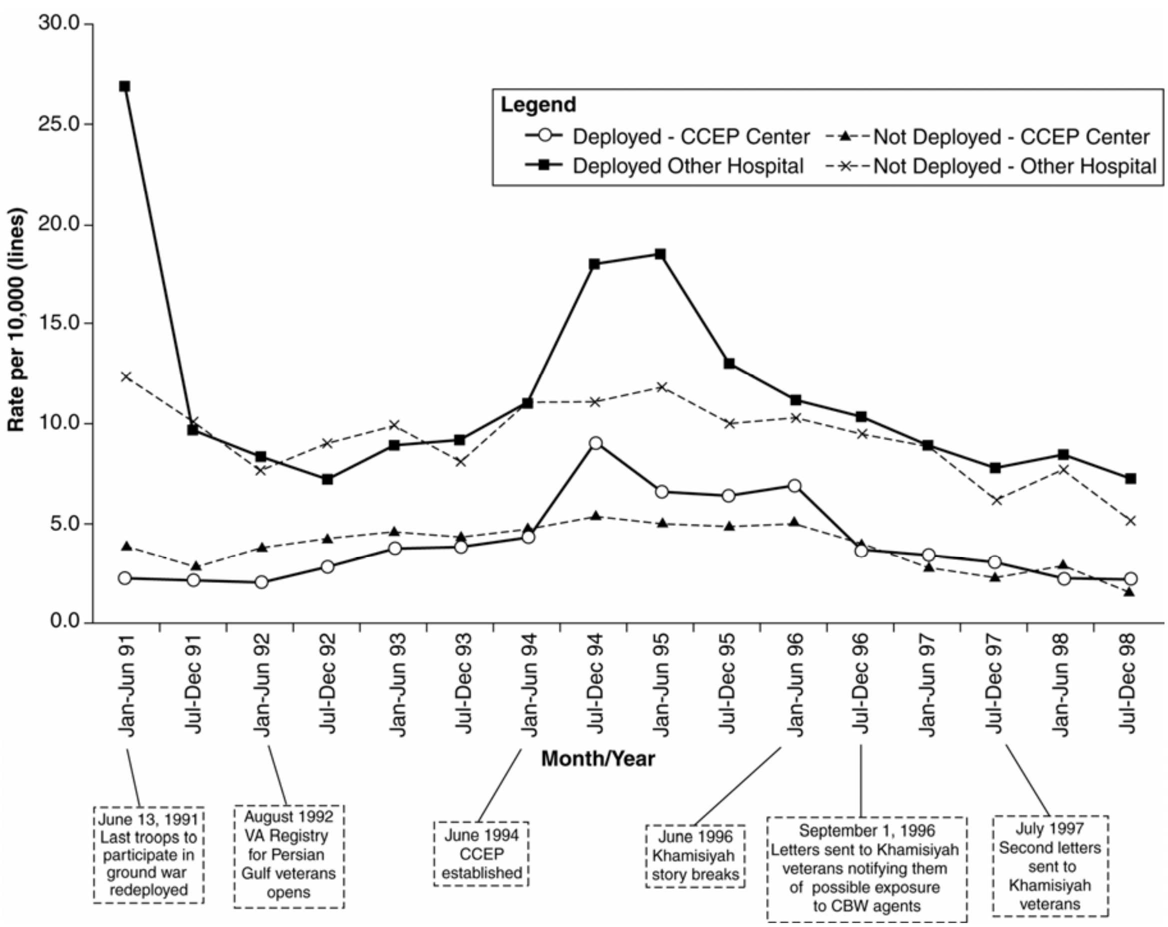
CCEP Registration

Post-deployment health registries, such as the CCEP, provide another source of information both on exposures and health outcomes. The CCEP has been utilized in Gulf War-related research (1, 66). However, the CCEP data are somewhat limited because registration in the CCEP was voluntary, resulting in self-selection bias. It is also noteworthy that most Soldiers who registered with the CCEP were found to be healthy. Moreover, a large proportion of CCEP registrants were found to have conditions commonly found in any large population (e.g., hypertension), which may occlude the significance of important findings (especially instances of rare conditions).

In addition, the CCEP program itself, and the related exams, may have resulted in artificially inflated hospital admission rates, thus making studies of hospitalization outcomes among GW veterans less valuable. For example, it is possible that the extensive clinical evaluations required under the program may have caused some referral centers to hospitalize deployed veterans for logistical reasons rather than medical necessity, potentially resulting in artificially inflated hospital admissions among deployed veterans. Moreover, the awareness of the creation of these health registries may have caused veterans suffering from conditions *not* related to deployment to attribute their symptoms to the war. That is, the war or other deployment-related experiences may have provided a “focalizing point” for Soldiers suffering from various conditions (18). To evaluate the potential impact of CCEP program administrative actions on rates of hospital admissions, we compared admission rates for diagnoses common among CCEP registrants in facilities designated as regional CCEP centers to rates of these conditions in other MTFs (Figure 4). If there were a bias related to CCEP administration, we expected to observe an increase in rates of admission in CCEP facilities that was not mirrored in other MTFs. Though the increased rates in 1994 were most pronounced among deployed Gulf War Era Soldiers, non-deployed Gulf War Era Soldiers also experienced slight increases in admissions for CCEP25 disorders during this time period in both types of facilities. Boxes below the figure show dates of administrative events related to the war and the Army’s response to the health concerns of Gulf War Era veterans. The most noticeable peak in hospitalization rates occurred just after the CCEP was established. While trends in rates for CCEP25 disorders generally maintained a consistent decline after June 1996, there was a small peak among deployed Soldiers who sought care in non-CCEP facilities the second time letters were sent out informing deployed Soldiers that destruction of an Iraqi munitions

depot may have exposed US troops to trace levels of nerve agents. Interestingly, increases were also observed among nondeployed soldiers after the date the letters were sent out suggesting that either there were other factors influencing rates of illness during this time period that may affect both deployed and nondeployed soldiers; or that there may be a normative effect such that increased awareness of conditions and symptoms affected health seeking behavior among both deployed AND nondeployed soldiers.

Figure 4. Rates of inpatient hospitalizations for top 25 CCEP disorders at regional CCEP centers and other military medical facilities, among deployed and non-deployed Gulf War Era veterans, and key dates pertaining to provision of medical care for Gulf War veterans, 1991-1998



In addition to the limitations described above, we have uncovered some other data quality problems in the CCEP registry data, some of which may have been inadvertently introduced by the administrators of the CCEP database. Registration in the CCEP included a clinical examination and the completion of a comprehensive survey on exposure to hypothesized stressors in the war zone (e.g., chemical or biological warfare agents, vaccines). This questionnaire included an item that queried respondents specifically on whether or not they served in the Gulf War (item #122). Managers of the CCEP database unfortunately made an administrative decision to delete this item, as they believed a response to any of the items asking about specific exposures in the Gulf was indicative of having been actually deployed. It is a truism in survey research, however, that no matter how carefully the skip instructions in a questionnaire have been constructed, there will be some proportion of respondents who will inappropriately skip or answer items that do not apply to them (38). The administrative decision to eliminate the responses to this question has limited our ability to evaluate these data for quality and completeness.

In addition, this decision has limited our ability to conduct validation studies to assess the accuracy of deployment (activation) data. If the response to the CCEP questionnaire item had been left in the database, we could have more easily (and perhaps more accurately) compared the responses on that item to information in the Gulf War deployment activation file in order to develop more precise estimates of the extent of misclassification bias in the activation file. (Our efforts to explore the validity of the information in the Gulf War activation files are described in more detail in the section that follows.) One of the most important contributions the TAIHOD team can make is in communicating its experiences with administrative data back to the Army agencies that collect the data and suggest ways to facilitate better data collection that will make high-quality and cost-efficient epidemiologic research possible.

Deployment Activation Files

The TAIHOD includes records from the DMDC on deployment to ODS/DS. While deployment status is a key piece of information for the assessment of the health of GWE veterans, exploration and use of these data have raised concern about their overall accuracy. Because the TAIHOD comprises a conglomeration of secondary data files, we cannot directly control the accuracy or the reliability of the data we receive. We must, however, evaluate the quality of the data we receive before using it in epidemiologic research, and we have begun to explore the overall quality, completeness, and potential biases of the Gulf War deployment activation datafiles.

After the Gulf War ended, the services did their best to create files that identified Soldiers who were deployed to the conflict. These files were subsequently used by many researchers, ourselves included, to conduct epidemiologic studies of Gulf War Illnesses (GWI) (12, 13, 23, 28, 39, 43, 53-56, 67-71, 108, 110-114, 117, 127). To date, there have not been any published studies systematically evaluating the quality of these data. Several researchers have noted anomalies in these files, however. Steele and her co-investigators on the Kansas Persian Gulf War Veterans Health Initiative

Program reported an overall discordance between self-reported deployment status and military personnel records of approximately 7% (111). This degree of misreporting seemed, however, to vary among the study groups; 15% of the GWE veterans, whose DMDC records indicated that they had not gone to the Gulf, reported that they were in fact there. In a separate study of Gulf War veterans in the Pacific Northwest, McCauley et al. found that 8.5% of the Soldiers who had deployment status records in the DMDC files reported that they had not actually deployed (86). Anecdotal evidence from some of these veterans suggested that although their unit had been deployed, circumstances had occurred that prevented them from being deployed with their unit. In a follow-up study, McCauley et al. contacted a sample of Gulf War veterans from the Pacific Northwest by telephone to interview them about their experiences. To their surprise, 274 (9%) reported that they were not on active duty in either the Army or National Guard during the war, and another 231 (8%) reported that they were veterans of prior conflicts (e.g., Vietnam), but that they had not participated in ODS/DS (87). Finally, in testimony before the Senate Committee on Veterans' Affairs, Stephen P. Backhus noted that these shortcomings in accurately capturing deployment status continued to be problematic in subsequent deployments (14). Dr. Backhus noted that DMDC records for Operation Joint Endeavor did not include records for 200 Navy sailors who had truly deployed to Bosnia, and that it incorrectly included records for Air Force personnel who had never deployed. Furthermore, Dr. Backhus pointed out that although an Institute of Medicine report had recommended that the DoD implement a system for tracking movement of service members within the theater of operations, this recommendation had not been implemented in sufficient time to be used for Operation Joint Endeavor.

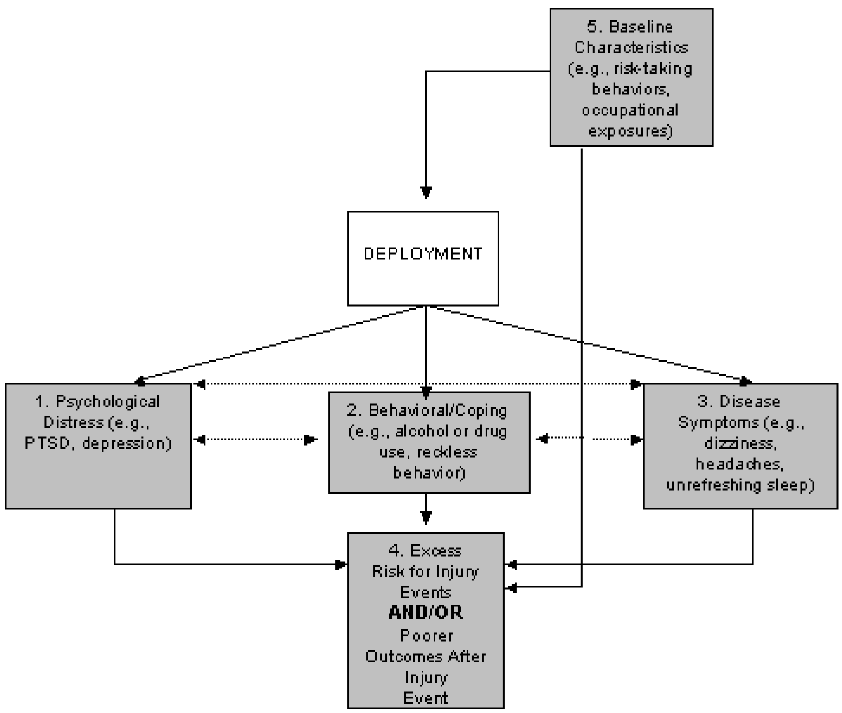
There is a likelihood that misclassification error may have occurred with respect to deployment status and that this error may have been systematic. For example, National Guard or Reservists may have been more or less likely to be miscoded than regular active duty Soldiers or, even more concerning, there may have been an association with health status and accuracy of deployment information. For example, if a Soldier who was sick could not deploy with his unit but nonetheless was coded as deployed (because most of his unit was deployed), this might erroneously suggest an association between illness and deployment. Efforts are underway to quantify the extent and potential impact of misclassification of deployment status. We are conducting a multi-site study to evaluate the extent of misclassification error and the impact it may have on published accounts of the effect of deployment on Soldier health. Collaborating with researchers at other institutions will allow us to use multiple sources of data to more accurately assess both the magnitude and direction of any bias in whether Soldiers have been defined as having been deployed or not deployed.

Injuries

Accidental injury and death has not been a major focus of inquiry with regard to the health of deployed GWE veterans, in spite of the fact that it is the only documented source of excess mortality in the post-war period (67). Historically, excess injury mortality was observed not only among U.S. but also among Australian veterans of the Vietnam conflict (29, 31-34, 46, 76, 116, 120, 121). We have proposed an analytic model suggesting five possible pathways by which deployment may increase post-war

risk of injury (see Figure 5). First, increases in injury mortality may be a consequence of depression, PTSD, and symptoms of other psychiatric conditions that emerge after deployment. Second, physical and psychological traumas experienced during deployment may lead to the post-war adoption of coping behaviors that might increase injury risk (e.g., alcohol or substance abuse). Third, the observed increase in injury risk may be the indirect consequence of the ill-defined symptoms reported by many ODS/DS veterans (e.g., concentration or memory deficits, difficulty sleeping). Fourth, deployed veterans may experience poorer survivability for a given injury event, resulting in greater mortality but not morbidity. Finally, the process that selects individuals for deployment may lead to a spurious association between deployment and injury, by preferentially selecting individuals who are risk takers and/or exposed to greater hazards (22, 23).

Figure 5. Potential explanations for the association between deployment and injury



Because the TAIHOD was originally created for the study of injury and because the research team has extensive experience in injury epidemiology, we are well prepared to assess this excess injury burden among deployed Soldiers. To date, however, there have not been enough resources available for this line of inquiry to utilize the TAIHOD in order to explore potential etiologic pathways linking deployment to excess post-war injury.

Deaths

Given the scale of the deployment and the rapid pace at which Soldiers were dispatched to the Gulf, deaths were relatively uncommon both during and since ODS/DS. During the deployment, there were 147 combat casualties and 225 deaths from injury and illness (127). Among ODS/DS veterans, death is still a relatively rare occurrence; in the 2 years following the war, 1765 Soldiers who deployed to the Gulf died (67). Although rare during ODS/DS, deaths are a devastating outcome and thus important to consider. In addition, the more recent Operation Iraqi Freedom (OIF), the largest military action since the Vietnam War, has resulted in many more casualties than were seen during ODS/DS. The TAIHOD is well poised for a study of non-battle injury occurring during and after deployments in support of OIF. The TAIHOD includes information on all servicemembers who died while on active duty, although the database has not yet been tapped for researching this type of outcome in relation to deployment. Though these data have not been fully explored, and although an assessment of casualties from ODS/DS was beyond the scope of the pilot study described in this report, the TAIHOD nonetheless has potential in this area of Force Health Protection research, especially with regard to the study of injury deaths.

RISK FACTORS, EXPOSURES, AND HEALTH BEHAVIORS

A key objective of the pilot TAIHOD study of ODS/DS veterans was to assess the potential role of stress and distress as a risk factor or effect modifier of the health of deployed GWE veterans. Initial plans for this called for pre- and post-war comparisons of measures of stress and distress contained in the Army's HRA surveys.

The Health Risk Appraisal (HRA)

One of the key data sources in our original grant proposal on health behaviors, stress, and distress as risk factors for GWI was the Army HRA. One of the biggest challenges and disappointments we have faced in our work has been the discovery that we had no pre-Gulf War Army HRAs available for analysis. We had originally anticipated having more than 22,000 completed surveys, with approximately 1,000 from Soldiers who deployed to ODS/DS. However, all of these surveys were ultimately deemed unusable due to one or more of the following problems. First, many HRA surveys in the database were not actually completed by an active duty servicemember. Even though the HRAs had SSNs, it was often difficult to determine whether the survey responses were truly those of an active duty Soldier or of a dependent family member. The HRA is offered to spouses and dependents who may complete the HRA under their sponsor's SSN. We took a conservative approach in data cleaning and management, and if we found that we could not positively determine whether a survey was completed by an active duty Soldier or by a family member, we excluded it from analysis. In addition, there were many duplicate and near duplicate surveys, often taken on or about the same day. We eliminated duplicates and in cases of near duplicates, we retained the one with the most completed responses. This cleaning step resulted in 393 surveys we believed to be valid for the pre-Gulf war period (107 surveys completed by Soldiers who later deployed to the Gulf and 286 surveys completed by non-deployers in the pre-

war period). We published a paper describing the demographic, health, and behavioral profile of non-deployed and deployed Soldiers in the pre-war period based, in part, on these surveys (23). The sample of Soldiers completing pre-war HRA surveys was small. Findings from analyses of the surveys were non-significant (insignificant?), but did seem to be consistent with results from analyses of hospitalization and demographic data, which were statistically significant. The hospitalization and demographic data showed decreased risk in the pre-war period for hospitalizations from all causes and for conditions most common among post-war CCEP registrants, but increased risk in the pre-war period for injuries.

Unfortunately, we subsequently developed evidence suggesting that *none* of these surveys were actually taken prior to the war. We believed we had obtained all of the HRA data, including files for surveys completed in the late 1980s, but have recently learned that the electronic repository of HRAs that we received was initiated in October of 1990 (that is, after the August 1990 invasion of Kuwait), and that all earlier HRAs (from 1987-1990) were kept in a separate database. The surveys we had, which we believed to be pre-war surveys, bear incorrect dates. This likely occurred because the HRA date information is read in from the DOS or Windows clock on the local computer when the survey was scanned. If the computer's clock was set incorrectly, an incorrect date of administration would have been recorded for that HRA, even though the software manual for the administration software cautioned HRA program administrators numerous times about this issue (2). It is not known how widespread this problem may have been. We have submitted a letter to the editors of *Military Medicine* in an attempt to document this problem and to ensure that other researchers are not misled by the erroneous findings we initially reported. In addition, we have continued our efforts to locate the surveys that were believed to have been completed in the late 1980s and early 1990s. We have interviewed numerous members of the original HRA project team, and although they all attest to having processed tens of thousands of HRAs between 1987 and 1990, no one seems to know where the electronic database that contains those surveys currently resides.

In addition to seeking information about the missing HRAs, we conducted interviews with members of the original HRA and Army Health Promotion Program in an attempt to piece together the history of the HRA program, the origins of the survey items, and the management of the resulting data. It has been extremely challenging because many of the individuals originally tasked with creating the database have since retired from the military or have little recollection of the program. Many of our findings have been detailed in a series of reports on the HRA program (26, 105).
Though the TAIHOD currently does not contain HRAs that were completed in the period preceding ODS/DS, it does contain many more HRAs that appear to have been taken after the Gulf War (based on cross-checking the age the respondent reported on the survey and the birth date recorded in the personnel files). Others who plan to use HRA data for research purposes will need to take extra care in qualifying the survey date if it is important to establish a certain temporal order of the survey against the health outcome date they are studying. Among the 1,336,050 Soldiers on active duty between June 1991, and December 1998, we have more than 521,000 HRA surveys representing 408,374 individuals that have been positively linked to an active-duty

Soldier. This suggests that there are more numerous opportunities to investigate risk factors for health outcomes associated with more recent deployments than were present in the cohort of GWE veterans. Unfortunately, because the HRA program was officially discontinued in 1998 and because the HEAR is still not off the ground, the opportunity for studying health behaviors and health outcomes is diminishing with time. There is no representative repository of health habit data to study these types of risk factors pre- and post-more recent deployments. Some larger cohort studies currently underway may help address some of this limitation; for example, the Millennium Cohort Study (http://www.millenniumcohort.org). In addition, the so called "pre- and post-deployment surveys" also have the potential to help identify risk factors that affect deployed Soldiers health (http://www.ha.osd.mil/policies/1999/clin9902.htm).

Other Sources of Data on Stress

One of the fortunate aspects of working with a database as rich and varied as the TAIHOD is that even though we did not have sufficient pre-war HRAs, we were able to use other components of the database to create proxy measures of pre-war stressors. There is a great deal of interest in how demographic characteristics, occupational stressors, and familial factors may interact with deployment to influence susceptibility to stress and adverse health outcomes (100).

The TAIHOD contains extensive demographic and occupational information that is updated semiannually. This is an important strength of the TAIHOD because it allows us to identify subpopulations particularly at risk, to control for potential confounders, and to accurately assess population-based risk for various health outcomes. Because these data are updated at such frequent intervals, we are able to assess changes in health outcomes associated with changes in risk profiles (e.g., changes in marital status, job assignments, and hazardous duty exposures). We used pre-war demographic and personnel data to measure life events and changes likely to be stressful and that might interact with deployment to affect health. We hypothesized that Soldiers who experience a greater number of life events or putative stressors in the immediate pre-war era might be at greater risk for morbidity regardless of deployment status, and that these experiences may interact with deployment to increase risk.

To address these hypotheses, we identified a cohort of 511,449 enlisted Soldiers[1] on continuous active duty from December 1989 through June 1990 and measured several personal and occupational life events that occurred prior to the war (i.e., July 1, 1990). We followed these Soldiers through December of 1994 (i.e., 3 years after the end of the war) to assess risk for five specific health outcomes: any hospitalization, injury hospitalization, hospitalization for ill-defined signs and symptoms, hospitalization for psychiatric-related conditions, and hospitalization for musculoskeletal conditions. These outcomes were selected because they were of clinical importance (e.g., injuries are only known cause for excess post-war mortality), because an *a priori*

[1]We selected only enlisted soldiers for this analysis in order to avoid problems related to near multi-collinearity between rank and occupation (some occupations are open to only enlisted soldiers or to officers), and because enlisted soldiers are a larger group offering greater power for the study of life events and health outcomes.

determination was made that these outcomes were a logical outcome of stress exposure (e.g., psychiatric conditions have been linked to stress or distress), and/or because these conditions were prevalent among Soldiers who went to the Persian Gulf (e.g., the top three diagnoses for veterans enrolled in the CCEP program, other than "healthy," included musculoskeletal disorders, psychiatric conditions, and ill-defined signs and symptoms). We used a three-digit level of aggregation in defining our outcome variables and examined only primary diagnoses.

Pre-war measures of potentially stressful events were assessed prior to June 1990. Pre-war status changes such as marital status or unit location were assessed between December 1989 and June 1990. This analysis is still underway, but to date, we have examined the impact of changes in unit location (i.e., change in ZIP code), number of dependents, marital status, grade extremes (i.e., either short or long in grade), spouse on active duty (particularly if he/she is also deployed), and discordance between primary MOS (the job an individual is trained for) and duty MOS (what they are actually assigned to do). We also control for the potential confounding effects of age, gender, rank, race, total time in service, and Career Management Field. We used standard time-to-event statistical techniques including Cox Proportional Hazard models and Kaplan-Meier Survival curves.

Table 2 shows results from preliminary analyses of these data. This table shows the unadjusted influence of deployment on risk for each health outcome in the 3-year follow-up period. In the unadjusted model, deployers were significantly *less* likely to be hospitalized for any cause or for signs, symptoms, and ill-defined conditions. On the other hand, they were significantly *more* likely to experience a psychiatric or injuryrelated hospitalization. The data demonstrate one of the advantages of having a variety of demographic and other information available to control for potential confounding. The bottom row of the table showing results from multivariate models indicates that once we control for age, gender, rank, race, education, occupation, and pre-war life stressors, such as change in marital status, moving, and having a spouse deployed, the effect of deployment, though still significant, is greatly reduced for injury hospitalization. Likewise, the apparent protective effect of deployment on risk for Ill-Defined Signs and Symptoms is mitigated by the inclusion of demographic characteristics and pre-war stressor covariates in the model. The post-war increased risk for psychiatric hospitalizations, however, does not seem to have been attenuated by the inclusion of covariates in the full model. Deployed Soldiers are at greater risk for a psychiatric hospitalization after redeployment even after we control for demographic characteristics and pre-war life events.

Table 2. Univariate and Multivariate Cox Proportional Hazard Models: The Influence of Deployment and Pre-war Stressful Life Events on Selected Health Outcomes of Gulf War Era Veterans, 1990-1993.

Variable	Any Hospitalization	Injury Hospitalization	Psychiatric Hospitalization	Musculo-skeletal Hospitalization	Ill-Defined Signs & Symptom Hospitalization
Deployment Only	0.98‡	1.20‡	1.14‡	0.98	0.85‡
Adjusted Deployment*	1.06‡	1.06‡	1.13‡	1.02	0.98

‡p<.05
*Influence of deployment after adjusting for change in unit location (ZIP code), change in number of dependents, change in marital status, low or high average time in service for rank, spouse's active duty and his/her deployment status, discordance between trained and actual job assignment (primary versusduty MOS), education, age, gender, rank, race, and MOS.

Table 3 shows the hazard ratios for specific types of hypothesized life stressors and their influence on each health outcome. Though not shown, this model also controlled for age, gender, race, rank, MOS (job), education, and deployment. While most of these stress-related variables were significant in univariate models, the overall impression is that once we account for demographics and deployment, the effect of these pre-war stressors is rather small, even where they are statistically significant. There are, however, a few possible and notable exceptions. First, a change in unit location (i.e., moving) in the time period *before* deployment (i.e., in our analyses we assessed between 3 and 18 months before the war began) is related to an increased risk for post-war health problems, even after controlling for deployment. Second, having a spouse on active duty, especially if he or she was also deployed to the Gulf, increased the risk for a post-war hospitalization by about 10% as compared to being single. The etiology of such an association is not clear. If it were related to stress or distress, then we would expect the association to hold for psychiatric-related hospitalizations as well. In contrast, single Soldiers (the referent group) appear at greatest risk for a psychiatric hospitalization in the post-war period. Third, being in a given rank for an excessively long time (longer than the other 80% of the cohort) increases risk of hospitalization, in general, and specifically for hospitalizations related to signs, symptoms, ill-defined conditions, and musculoskeletal disorders. The referent group (i.e., those in their grade for a very short time) is at lowest risk. On the other hand, risk of injury in the post-war period is lower among those in their grade the very longest, even after controlling for age and MOS. This might suggest that these Soldiers are in their jobs for a long time and understand the risks well and may be, therefore, at lower risk for an occupationally related injury. It could also have to do with their behaviors and propensity for risk taking, which could influence both their injury risk and their promotability.

Table 3. Multivariate Proportional Hazard Models: Pre-war Stressful Life Events, Deployment and Post-war Hospitalizations Among Enlisted Army Soldiers, 1990-1993*

Variable	Any Hospitalization	Injury Hospitalization	Psychiatric Hospitalization	Musculo-skeletal Hospitalization	Ill-Defined Signs & Symptom Hospitalization
Change in unit ZIP					
No Change	1.00	1.00	1.00	1.00	1.00
Change	1.04‡	1.03‡	1.09‡	1.02	1.03
Primary/Duty MOS					
Agreement	1.00	1.00	1.00	1.00	1.00
Discordance	1.02‡	1.00	1.09‡	1.00	0.96
Number of Dependents					
No Change	1.00	1.00	1.00	1.00	1.00
Change	1.02	0.97	0.94	1.09‡	1.02
Marital Status					
Single	1.00	1.00	1.00	1.00	1.00
Spouse not on active duty	1.05‡	0.87‡	0.94‡	1.05‡	1.05
Spouse on active duty, not deployed	1.07‡	0.92	0.90	1.01	1.01
Spouse on active duty, deployed	1.10‡	1.07	0.81	0.96	0.93
Time in Grade					
Shortest	1.00	1.00	1.00	1.00	1.00
Short	1.00	0.99	1.02	1.01	1.02
Average	1.00	0.97	0.92‡	1.02	1.07
Long	1.01	0.93‡	0.95	1.07‡	1.09
Very Long	1.06‡	0.91‡	0.96	1.11‡	1.17‡

*Model also controls for age, gender, race, rank, MOS (job), education, and deployment. (Hazard ratios not shown.)
‡ p<.05

Certain factors such as educational attainment, intelligence, and social support may help Soldiers cope with stressors. The Armed Services Vocational Aptitude Battery (ASVAB) is a measure of aptitude that all enlisted Soldiers must take upon entry to the military (82). It measures various dimensions of intelligence, such as word knowledge, paragraph comprehension, arithmetic reasoning, and mathematic knowledge. We are currently exploring the utility of the ASVAB as an indicator of resiliency, but have not yet completed these analyses.

In addition to exploring changes in risks and exposure to stressors in the pre-war period, the breadth and scope of demographic data available in the TAIHOD also allow us to compare baseline differences in demographic characteristics between deployed and non-deployed Soldiers. This is a necessary step before it is possible to make a determination about differences between deployed and non-deployed Soldiers in the post-war period. These data allowed us to publish findings related to pre-war (baseline) demographic and health status that had not previously been reported in the literature (23). Our work revealed that Soldiers who were deployed for ODS/DS were more likely to have received special pay for hazardous duty exposures occurring prior to deployment than were their non-deployed peers, even after controlling for occupation. In addition, we found an excess injury hospitalization risk for deployed Soldiers in the

pre-war period even after controlling for demographic factors and occupation. This suggests deployed Soldiers may be greater risk takers and/or more likely to experience exposures that would increase risk for injuries, such as parachuting duty (30). These exposures could have persisted throughout and after the war and may explain, in part, the excess injury mortality that has been documented among post-war ODS/DS veterans (67).

The same approach we have taken to evaluating life changes and influences on deployed and non-deployed Soldiers can be used to identify potentially high-risk groups of Soldiers in future deployments. It also suggests that more research should be done to assess the generalizability of these findings to other types of deployments and perhaps to other health outcomes.

DMDC Surveys of Active Duty Soldiers

The TAIHOD contains other survey data that may be used to better understand the diverse factors that could affect the health of deployed Soldiers. As described earlier in this report, the DMDC administered surveys to a stratified random sample of active duty military in 1985, 1992, and 1999. While the forms varied slightly across years, there were many items that were identical for each survey that will allow us to make many important comparisons across time. We believe that this survey contains information that will prove useful in the study of stress and deployment-related health. Though this was not specifically included in our pilot grant, we have begun exploring these data in order to assess how well they might be able to address some of our research interests.

We compared responses to 14 survey items that appeared on both the 1985 and 1992 surveys and that related to satisfaction with military life (e.g., personal freedom, job security) among Soldiers who took this survey in both years. We also created a summary variable that summed scores for all 14 variables and compared summed scores at Time 1 and Time 2. For ease of comparison we dichotomized the variables to reflect a decrease in satisfaction from 1985 to 1992 versus no decrease (see Table 4).

When we examined changes in satisfaction based on the overall sum of scores for the 14 items, more than half of all Soldiers, both deployed and non-deployed, showed a decrease in satisfaction over time. However, deployed Soldiers reported steeper decreases in satisfaction: 58% of deployed respondents compared to 51% of non-deployed respondents showed decreases in satisfaction from 1985 to 1992.

When we examined decreases in satisfaction for each of the individual 14 survey items using chi-square tests, deployers were generally more likely to show decreases than were non-deployers, but surprisingly, this reached statistical significance only for the variable that asked about satisfaction with the opportunity to serve their country. Dissatisfaction with job training/in-service education and working/environmental conditions was also greater for deployers, but not significant at the standard .05 level.

Because parametric tests are generally more powerful, we also ran ANOVA models to compare the mean differences in total (summed) scores from 1985 to 1992 across deployed and non-deployed Soldiers and for each of the individual 14 items. As before, both groups showed decreases in satisfaction, and the decrease was significantly greater for deployers than non-deployers. With the ANOVA model, all the items shown here reach statistical significance.

Because both groups reported declines in satisfaction, this could reflect an aging or cohort effect, or it might reflect actual declines in overall satisfaction with military life. Because satisfaction declined more among deployers than it did among non-deployers, this could be related to their experiences in the Gulf or, because these analyses are not controlling for demographics, could reflect greater declines in satisfaction among certain demographic groups who were also more likely to deploy. It may be more important, however, to understand how these changes in satisfaction, coupled with deployment, may affect the health and well-being of Soldiers. Future analyses could focus on these variables and their relationship with health outcomes.

Table 4. Changes in Satisfaction Between Soldiers Who Did and Did Not Deploy to the Persian Gulf, as Documented in Selected Items from the 1985 and 1992 DMDC Occupational Surveys

Variable (item)	**Percent Decrease from 1985 to 1992**		**Chi-Square p value**
	Deployed	Non-Deployed	
Composite of All 14 Variables on Satisfaction	58%	51%	p<.05
Opportunity to Serve Country	36%	27%	p<.005
Job Training/In-Service Educational Opportunities	36%	31%	p<.10
Work or Environmental Conditions	34%	29%	p<.15

* Note: All Survey Items Shown were Statistically Significant in ANOVA models at p<.05.

TAIHOD AND VA PILOT LINKAGE EFFORT

Studies focusing only on Soldiers who remain on active duty may be susceptible to healthy worker bias. This bias would result in an underestimation of the true magnitude of morbidity and mortality, as only those who are most healthy remain on active duty. Because health records for Soldiers on active duty are maintained separately from those who have been discharged and are seeking care through the VA or civilian healthcare plans, most studies of deployed GWE veterans completed to date capture only the experiences of selected samples of veterans who are either still on active duty (53) (23) *or* who have left the military (89), *or* who are defined by a selected geographic area (117). Many of the government panels charged with evaluating the quality of research on GWI commented on how the research portfolio was hampered by restrictions on data sharing between the DoD and the VA (63, 96). In order to get a more cogent and complete assessment of the impact of deployment on Soldier health, longitudinal studies and collaborative ventures between these two agencies are needed.

In 2001 and 2002, the TAIHOD team embarked on a collaborative venture with the Massachusetts Veterans Administration Epidemiology Research and Information

Center to study the natural history of musculoskeletal injury, related disabilities, and how they impact utilization of care in the Army and VA healthcare systems. (126) Although not specifically related to deployment, the overriding goal of this venture was to assess the feasibility of linking Army and VA data. While the project met with some success, a number of challenges were identified that will need to be addressed before future collaborative work can be successfully completed: refining a protocol for linking data that preserves the integrity of the data while protecting the privacy of individual data; amassing enough computer resource space to house the large database and run analytic programs on the data; and better communication about appropriate avenues for data sharing and project management.

CHAPTER 3: RESEARCH RESOURCES: STRENGTHS AND WEAKNESSES OF THE TAIHOD AND OTHER LINKED DATABASES FOR FORCE HEALTH PROTECTION RESEARCH.

INTRODUCTION

Large databases, such as the TAIHOD, that link administrative data on demographics, health outcomes, exposures and risk factors, have been in use since the 1950s. The use of database exploration in epidemiology is a rapidly growing field, and there have been many recent articles in the medical literature about the benefits and the methodological hazards commensurate in their use (17, 78, 99, 125). These types of databases have been used to study conditions as varied as cardiovascular disease, cancer, congenital birth defects, hereditary conditions, neurological disorders, diabetes, infectious disease, and trauma (11, 15, 16, 19-21, 36, 37, 44, 58, 60-62, 75, 92, 102, 107, 123).

The civilian database research project that bears the closest similarity to the TAIHOD project is the Rochester Epidemiology Project. Founded in 1966 and housed at the Mayo Clinic in Rochester, MN, this project links medical records through a system of medical record management that was established in 1907 (88). Since then and up to this day, all patients who are treated at any Mayo Clinic facility or one of the affiliated hospitals are assigned a unique identifier. It is an important resource for population-based studies and has, in fact, been used to study conditions as wide ranging as cardiovascular disease; various cancers; musculoskeletal conditions (e.g., hip fracture, osteoporosis, Paget's disease); neurological conditions (especially epilepsy, Alzheimer's, and Parkinson's diseases); ophthalmologic conditions (e.g., cataracts, retinal detachment); endocrine or autoimmune disorders (e.g., diabetes mellitus, hyperparathyroidism, and lupus); and a host of other infectious and acute conditions. Studies have documented not only the prevalence of these conditions and their etiologic origins, but also have examined the relative efficacies of various treatments, or the consequences of treatment modalities and referral patterns on outcomes. This rich epidemiologic resource has resulted in the publication of more than 900 peer-reviewed journal articles and has contributed enormously to our understanding of acute and chronic disease processes. The TAIHOD has a structure very similar to the Rochester Epidemiology Project, with the potential for studying a wide range of conditions of importance to Army Soldiers.

CHALLENGES

The data contained in the TAIHOD are administrative in origin and were not collected specifically for research purposes. Thus, there are important limitations to their use and interpretation that must be well understood before any given study is initiated. For example, measures of exposures and health outcomes are not typically assessed for reliability or validity in any rigorous way before they are received at USARIEM. Data

quality and accuracy are typically of greater importance in a research setting than for administrative purposes. Data misclassification may be randomly distributed, but if it is non-random or systematic, it can significantly bias research findings. Researchers who use administrative data sources in epidemiologic work must be cognizant of the many issues that surround data collection and interpretation and proceed cautiously in analyses. In the next section we describe some of the different ways in which we have used these secondary data for research purposes, highlighting the pitfalls we discovered, and options available for addressing data limitations.

One challenge in maintaining internal funding for the TAIHOD project has been the concern over whether or not work with the TAIHOD may be most accurately labeled as research or surveillance. Within the DoD there has been an attempt to distinguish between research and surveillance missions, but this distinction is not always clear and seems to have resulted, in some cases, in disputes over appropriate job roles, competition for funding, and discrepancies in the level of scrutiny related to data protection. Generally, activities labeled as “surveillance” are not subject to human use oversight, while “research” activities, even when they use the same or similar data, can proceed only after rigorous scientific and human use review and approval (6). At a superficial level, the fact that the TAIHOD draws upon data collected for administrative purposes and not specifically for research may appear to blur the boundaries or add to confusion between what constitutes research and what constitutes surveillance.

Research and surveillance are two distinct, though often confused, enterprises with different goals, data requirements, and analytic methods. Surveillance databases are typically used to monitor specific known causes of injury or illness, track rates and trends, and plan for the efficient allocation of health-delivery resources (101). This information is useful for identifying appropriate research questions and activities in order to delve further into the problem. In contrast, although research may often rely on data obtained from multiple surveillance projects and administrative sources, the primary goal of research is to identify new risk factors or causes of injury or illness. Surveillance data must be collected in routine and consistent ways in order to facilitate the evaluation of rates over time; such data systems are typically designed to be flexible and simple, while producing data that are timely and representative. Research studies must be designed to withstand rigorous statistical and scientific scrutiny, and where research projects draw upon surveillance data, careful attention to the idiosyncrasies of data collection efforts, coding, and recoding is essential to research efforts. For example, the importance of accurately matching information on unique individuals in a database to be used for research purposes cannot be overstated, as incorrect matches may compromise the integrity of the tool, invalidate the results of the research, or mask true associations. A similar example can be illustrated with the Army hospitalization databases, which contain records of transfer events (i.e., continuation of care for the same injury event) and Carded for Record only files on DOAs, ER deaths, and disabled Soldiers. Misclassifying transfer cases as separate events has been shown to impact estimates of effect in studies of injury outcomes (52, 91, 106, 122). Similarly, although CRO records contain information that is useful in the study of deaths and disabilities, it would be inappropriate to count them as bona fide episodes of hospitalization (5, 7, 106). The ability to conduct epidemiologic research using surveillance data is thus, in

part, a fortunate byproduct of meticulous record keeping by administrative and surveillance projects, but research using surveillance data must always be carried out with an awareness of these idiosyncrasies. The analytic methods used in surveillance and research also may differ. Surveillance efforts typically use statistical methods that are straightforward and descriptive (101). In contrast, research typically employs more complex methods with rigorous controls over potential confounding factors. Research activities also begin with an *a priori* hypothesis to be tested and often employ use of a control group in order to separate out true effects from random error or confounding (101). Surveillance and research are therefore complementary activities; each represents a vital component of any comprehensive injury or illness control program.

Another challenge to using linked secondary data such as those contained in the TAIHOD, pertains to the ever-increasing concerns about confidentiality and privacy of personal information. It should be noted that public health research in the Army typically undergoes more rigorous scrutiny and oversight with regard to protection of human subjects and confidentiality than perhaps surveillance efforts. Surveillance efforts are policed by a completely different process (9) (6). The ever-growing concerns about confidentiality and privacy of medical records and the impact this may have on epidemiologic work using large databases has recently received widespread attention (65, 77, 85, 90, 118, 128). A recent Government Accountability Office (GAO) report about privacy issues surrounding data linkage acknowledged the concerns of privacy advocates, but noted that such research projects hold considerable benefits to public health. The GAO report describes a variety of techniques to address privacy issues, while allowing collaborative research projects involving data linkage to proceed (118).

BENEFITS

While maintaining a large linked research database, such as the TAIHOD, is not without its challenges, there are numerous opportunities that should be noted. The TAIHOD is a ready tool that can be used to address a wide range of research interests rapidly and cost-effectively. While databases can be put together from scratch in order to answer questions of this nature, the TAIHOD is already well established. Furthermore, a team of individuals and collaborators familiar with the relevant component datasets are already actively engaged in similar research and could be rapidly mobilized to accomplish this critical Force Health Protection study.

Our approach to data management includes a combination of scrupulous data linkage and error checking, and deliberate efforts to systematically validate the quality of the data within the TAIHOD. New data that are integrated into the TAIHOD are cleaned and evaluated to eliminate anomalous entities (e.g., duplicate records). Because the TAIHOD contains such a broad range of data, we have been able to validate data components cost-effectively by comparing them to other sources of data within the TAIHOD. For example, we have validated the responses on the Army's HRA regarding alcohol consumption by comparing the responses on those items to hospitalization records for alcohol-related conditions such as cirrhosis and to discharges from the Army for alcoholism (27). Finally, we have experimented with methodologies used in the field of "Knowledge Discovery in Databases", which combines elements of data warehousing

and data mining. A recent example of this is the validation of gender coding in the TAIHOD using first and middle names, as well as gender specific diagnoses (3).

These include the ability to rapidly assess or evaluate the relative quality of data due to the presence of duplicate or redundant measures of some factors, and the ability to incorporate a wide range of information in a study. Because data are already linked and, in many cases, error-checked and cleaned, rapid assessment with little startup time is usually possible. This can greatly reduce research costs and shorten time to achieving results.

The TAIHOD is quite comprehensive, covering a diverse range of information on health outcomes and risk factors, which allows not only for the investigation of many different health concerns and behaviors, but also the ability to control for many potential confounders. Because the TAIHOD includes comprehensive information on *all* active duty Army Soldiers and covers such a long time span, it offers the opportunity to study health status and risk factors for adverse health outcomes before and after key events such as deployments. The breadth and depth of data available in the TAIHOD make it appealing as a potential source of information on the health of deployed Soldiers, as well as Soldiers performing peace-time missions.

The core TAIHOD research team includes a diverse group of skilled and experienced epidemiologists, programmers, and research scientists who have developed considerable experience with the idiosyncrasies, strengths, and limitations of the various components of the TAIHOD. In most cases, the staff has been working with TAIHOD data for at least 2 years and thus has already climbed much of the rather steep learning curve confronting any researcher who endeavors to work with any one of the many complex data files contained in the TAIHOD. A large network of outside collaborators also adds to the breadth and capabilities of the core TAIHOD team. The presence of an experienced, trained core staff of individuals who are familiar with the datasets facilitates the ability to quickly use data that might take an unfamiliar research team many months to fully understand. This may be particularly important when there is a potentially serious health problem that must be quickly assessed and/or where a policy decision must be made rapidly. When a researcher is ready to embark on a particular analysis, they will necessarily weigh the availability of data in any decision regarding choice of variables for analysis and study designs supported by the available data. If a wider range of variables is available, the researcher is able to make these decisions about data availability or acquisition time more on scientific merit than on administrative considerations. This has been one of the central premises used to justify creation and maintenance of the TAIHOD as a tool for research, as opposed to the one-by-one acquisition and assembly of datafiles for particular analyses. On the one hand, devotion of time and resources by the research team to database enhancements diverts efforts from the primary research activities, limiting the amount of analysis and publications on health-related research that can be completed. At the same time, these efforts hold the promise of greatly improving the efficiency and quality of future research.

Epidemiologic research also stands to improve the process of surveillance by highlighting limitations in data collection and providing feedback to those who maintain and collect surveillance data. For example, surveillance systems often rely upon records of inpatient hospitalizations in describing the scope of a particular health problem, such as injury. The inpatient hospital record contains useful demographic information, as well as information about the nature of the person's illness or injury. These hospital records, however, often lack detailed or specific information about the external factors that caused the patient's injury, which would be useful in research endeavors. The military hospital system uses the STANAG system for coding external cause of injury in general terms. Though the proportion of military injury hospital records with external cause-of-injury codes is higher than the proportion of civilian hospital records with this information, there are still limitations to conducting injury epidemiological research in the military and in making comparisons to routinely collected data on the U.S. population at large. Military injury researchers have long advocated for the adoption of a Minimum Basic Data Set for intentional and unintentional injuries and the universal application of cause of injury coding to medical records in military and civilian settings in order to improve the quality and quantity of detailed data available for injury research (79-81, 95). While the existing records with STANAG codes may assist surveillance experts in describing the nature and some of the causes of the injury problem in a specific population and in planning the allocation of resources (e.g., the design and delivery of educational interventions), researchers who hope to discover the underlying risk factors that contribute to these injuries would be assisted by greater availability of more detailed information about the external cause of the injury, particularly the more common injuries that are often treated in an outpatient setting. Research may also result in improvements in data quality by providing input to the development process for new data systems (e.g., the Army's CHCS II), including the ADS, as well as suggestions for capitalizing on the structure of existing systems (e.g., CHCS). Changes to coding systems used in recording data may also be beneficial. For example, the STANAG system or the International Classification of Diseases (ICD) may require modifications in order to improve accurate capture of data injury and illness, especially with regard to unique military requirements. In this way, research activities may lead to the development of new methodologies that make the surveillance process more productive, efficient, and accurate.

The TAIHOD data are continually being updated and thus new research opportunities continue to arise. This is important for identifying critical issues related to Force Health Protection. It also has the added benefit of enticing internationally renowned health researchers to develop collaborative relationships with active duty military researchers. All stand to benefit from such associations. Last year we completed a top to bottom review by a newly appointed panel of experts, the TAIHOD Steering Committee. This committee of outside experts includes senior scientists and specialists with expertise in informatics, epidemiological methods, ethics, and psychology. A member of a local Veteran's Service Organization was also included in order to represent the interests of the individuals whose data are contained in the database. The recommendations of this panel are being pursued and are expected to improve the quality and utility of the TAIHOD database project.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The TAIHOD represents a unique tool and strategy for epidemiologic research, in general. By investing resources in management of this data, a tool is readily available for emerging areas of interest, such as Force Health Protection research. While many of the same data sources exist elsewhere and are "cobbled together" as needed for specific analyses, there are some limitations to these efforts that are overcome by the ready availability of a system such as the TAIHOD.

Maintaining and actively managing the TAIHOD database may appear to be more expensive or less efficient than constructing limited, single-use datasets for specific sets of analyses. However, the opposite may in fact be true. Having it readily available allows for significant time savings in executing analyses and also allows investigators considerable freedom to select from a wide range of data sources. This minimizes the often lengthy process of data acquisition and cleaning. In balance, these databases are complicated, and there is a steep "learning curve" in terms of understanding the processes used to collect the data and the way the individual variables are constructed. Some databases have dozens of variables that appear to measure the same or similar attributes. The TAIHOD team has devoted considerable time to researching the origins of items and the exact definitions, strengths, and limitations of these variables. In the 10 years since its inception, the TAIHOD staff has gained important experience working together in managing and analyzing these data and is very familiar with the individual component database structures and idiosyncrasies of the variables contained within. Finally, the richness and breadth of the data contained in the TAIHOD often allows for rapid data quality checks where there is overlap or redundancy of information between different datafiles contained in the TAIHOD.

RECOMMENDATIONS

- Additional study of post-deployment injury using TAIHOD.
- Add data on other deployments to compare risks to ODS/DS deployment and to judge the effect of multiple deployments on Soldier health.
- Validate Gulf War deployment activation file(s).
- Use HRAs cautiously—be sure individual surveys are clearly those of active duty servicemembers and not his/her family members; be sure he/she is on active duty; attempt to remove duplicate scans; insure appropriate data are being linked by confirming HRA completion date and dates from other files, such as personnel, are reasonably close.
- Continue efforts to validate HRA items.
- Document reliability and validity of HEARS items.
- Continue to identify important research questions that can be addressed by this tool.

- Enhance collaborative research activities between TAIHOD and other sites using large linked databases to reduce any overlap and to take advantage of corporate knowledge regarding strengths and limitations of the data components.
- Re-evaluate the roles of surveillance and research activities in the military to clarify appropriate tasks.
- Review procedures in place in all facilities using linked databases to be sure all researchers are adhering to appropriate standards for the adequate protection of human subjects.
- Disseminate reports such as this document and others that highlight the strengths, limitations, and pitfalls that researchers using any of these databases must be aware of in order to conduct high-quality research.
- Continue development and exploitation of free text obtained from various sources including military hospitals, the Army Safety Center, the USAPDA, and the ACIPS.

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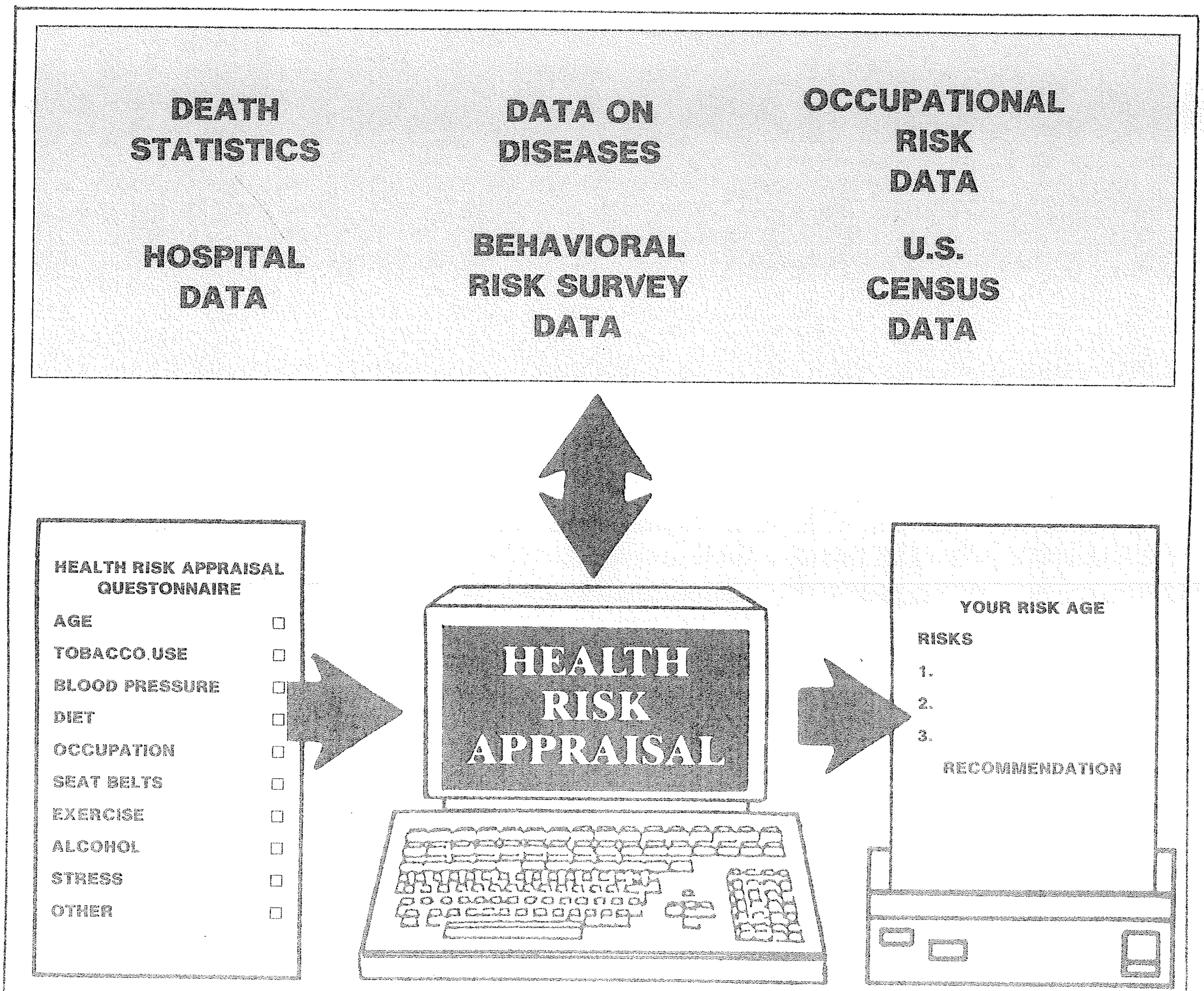
APPENDIX A: HRA SURVEY (1992)

THE HEALTH PROMOTION PROGRAM

Fit to Win

HEALTH RISK APPRAISAL



For use of this form, see AR40-501 and AR600-63; the proponent agency is TSG

DA Form 5675, 1 Feb 92 (Edition of Oct 90 is obsolete)

FIT TO WIN ★★★★★★★★★★ TM

The HEALTH RISK APPRAISAL is an activity of

THE HEALTH PROMOTION PROGRAM

How does the Health Risk Appraisal work?

The health risk appraisal is a personalized estimation of your risks of death and major illness in the next ten years. First, the program uses your age and health-related personal habits, as well as national statistics on risk factors and diseases, to calculate your current risks.

Your risk may be expressed in terms of RISK AGE or HEALTH SCORE. Ideally, you want a risk age lower than your real age or a health score of 100 points.

The second part of your health risk appraisal calculates your risks again, as if your risk factors were reduced as much as possible. The result is your "target" risk age or health score. It shows your potential benefit, in health terms, of improving your lifestyle-if you quit smoking, wear safety belts, take moderate exercise, etc.

Therefore, your health risk appraisal report includes your real age, your current risk age and your target risk age. Your current risk age tells you how healthy your lifestyle is right now, and your target risk age lets you know how much longer and healthier you can live with a few positive changes in your lifestyle.

PLEASE ANSWER QUESTIONS AS HONESTLY AND AS CORRECTLY AS YOU CAN. This will allow you to receive the most accurate assessment of your health.

The results of the Health Risk Appraisal are for you. We ask that you give us your name so we can return your results and any recommendations for follow-up care to you. We also ask for your social security number so we can statistically track trends in health awareness over long periods of time. Statistical information may be collected from an wide database which will contain your information, but your name and social security number will be covered and cannot be read.
The rules of the Privacy Act apply to any information that you give in the Health Risk Appraisal.

IMPORTANT NOTE! The health risk appraisal is no substitute for a physical examination or check-up. It will not give you a diagnosis nor will it tell you how long you will actually live. However, the health risk appraisal will help you understand and recognize your risk factors.

INSTRUCTIONS

Please use a No. 2 Pencil only to complete this survey. Make dark, black marks that fill the response boxes completely.

EXAMPLE: Correct Incorrect

Health Risk Appraisal (HRA)
for use of this form, see
AR40-501 and AR600-63;
the proponent is TSG

1. What is your branch of service?

1. ☐ U.S. Army ☐ U.S. Marines
☐ U.S. Navy ☐ U.S. Coast Guard
☐ U.S. Air Force ☐ Other

2. What is your military status?

2. ☐ Active ☐ Reserve
☐ Active Reserve ☐ Guard
☐ Active Guard ☐ Other

3. What is your current rank?

3.

ENLISTED		OFFICER		WARR. OFFIC.
☐ E-1	☐ E-6	☐ O-1	☐ O-6	☐ WO-1
☐ E-2	☐ E-7	☐ O-2	☐ O-7	☐ WO-2
☐ E-3	☐ E-8	☐ O-3	☐ O-8	☐ WO-3
☐ E-4	☐ E-9	☐ O-4	☐ O-9	☐ WO-4
☐ E-5		☐ O-5	☐ O-10	

4. What is your Unit Identification Code?
(Enter Specific Unit Identifier)

Print your Unit Identification Code in these blank boxes. →

Then fill in the corresponding response box below each number/letter.

4.

UNIT CODE					
A	A	A	A	A	A
B	B	B	B	B	B
C	C	C	C	C	C
D	D	D	D	D	D
E	E	E	E	E	E
F	F	F	F	F	F
G	G	G	G	G	G
H	H	H	H	H	H
I	I	I	I	I	I
J	J	J	J	J	J
K	K	K	K	K	K
L	L	L	L	L	L
M	M	M	M	M	M
N	N	N	N	N	N
O	O	O	O	O	O
P	P	P	P	P	P
Q	Q	Q	Q	Q	Q
R	R	R	R	R	R
S	S	S	S	S	S
T	T	T	T	T	T
U	U	U	U	U	U
V	V	V	V	V	V
W	W	W	W	W	W
X	X	X	X	X	X
Y	Y	Y	Y	Y	Y
Z	Z	Z	Z	Z	Z
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

PRIVACY ACT STATEMENT

AUTHORITY: 29 CFR Chapter XVII, Occupational Safety and Health Standards; 5 U.S.C., section 150; Executive Orders 11612 and 11807 authorize the collection of this information.

PURPOSE: The primary use of this information is by the unit medical care providers to assure competent medical care. Additional disclosures of this information may be: To the Office of the Surgeons General in aggregated form to develop Command fitness profiles; to military medical researchers for the purpose of correlating health precursors to health problems or to commercial medical researchers for the same purpose. Where data from this system of records are provided to agencies external to the military, Social Security Number and Name will be deleted.

ROUTINE USES: Information may be disclosed to departments and agencies of the Executive Branch in performance of their official duties relating to health risk appraisal and cardiovascular screening.

DISCLOSURE: We ask that your give your name so we can return your results and any recommendations for follow-up care to you. We also ask for your social security number so we can statistically track trends in health awareness over long periods of time.

5. [ ] Spouse (husband or wife of active duty or Military Retiree)
[ ] Retiree
[ ] Son or daughter of Active Duty or Military Retiree
[ ] DOD Employee
[ ] Non-DOD Employee
[ ] Other

Mark ALL categories applicable to you.

6.

[ ] WG	[ ] GS	[ ] SES	[ ] GM
[ ] 1	[ ] 6	[ ] 11	[ ] 16
[ ] 2	[ ] 7	[ ] 12	[ ] 17
[ ] 3	[ ] 8	[ ] 13	[ ] 18
[ ] 4	[ ] 9	[ ] 14	
[ ] 5	[ ] 10	[ ] 15	

6. If you are a Civilian Government Employee, enter your category and current pay grade.

7. LAST NAME | **FI**

										FI
A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D
E	E	E	E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H	H	H	H
I	I	I	I	I	I	I	I	I	I	I
J	J	J	J	J	J	J	J	J	J	J
K	K	K	K	K	K	K	K	K	K	K
L	L	L	L	L	L	L	L	L	L	L
M	M	M	M	M	M	M	M	M	M	M
N	N	N	N	N	N	N	N	N	N	N
O	O	O	O	O	O	O	O	O	O	O
P	P	P	P	P	P	P	P	P	P	P
Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
R	R	R	R	R	R	R	R	R	R	R
S	S	S	S	S	S	S	S	S	S	S
T	T	T	T	T	T	T	T	T	T	T
U	U	U	U	U	U	U	U	U	U	U
V	V	V	V	V	V	V	V	V	V	V
W	W	W	W	W	W	W	W	W	W	W
X	X	X	X	X	X	X	X	X	X	X
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z

FOR ALL INDIVIDUALS

7. Your Name.

Print the first ten letters of your last name and your first initial in these blank boxes.

Then fill in the corresponding response box below each letter.

8. [ ] AD or RM
[ ] Spouse of AD or RM
[ ] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] 5th Child
[ ] Not Applicable

8. ARE YOU: (Mark ALL applicable categories)
Active Duty or Retired Military
Spouse of Active Duty or Retired Military
1st, 2nd, 3rd, 4th, or 5th child of Active Duty or Retired Military
Not Applicable

9. **YOUR SPONSOR'S SOCIAL SECURITY NUMBER OR YOUR SOCIAL SECURITY NUMBER**

			–			–				
0	0	0		0	0		0	0	0	0
1	1	1		1	1		1	1	1	1
2	2	2		2	2		2	2	2	2
3	3	3		3	3		3	3	3	3
4	4	4		4	4		4	4	4	4
5	5	5		5	5		5	5	5	5
6	6	6		6	6		6	6	6	6
7	7	7		7	7		7	7	7	7
8	8	8		8	8		8	8	8	8
9	9	9		9	9		9	9	9	9

9. Print your SSN in the blank boxes. Then fill in the corresponding response box below each number.
* **If ACTIVE DUTY or RETIRED military, enter your SSN**
* **If a FAMILY MEMBER OF active duty or retired, enter sponsors SSN**
* **For ALL OTHERS, enter your SSN**

10. **This Health Risk Appraisal is being administered in the following situation:**

10. ☐ In-Processing
☐ Periodic Physical Examination
☐ Pre-Physical Fitness Test
☐ Occupational Health Program
☐ Walk-In
☐ Other

11. **Racial/Ethnic Background**
Mark the most appropriate category.

11. ☐ American Indian or Alaska Native
☐ Asian/Oriental ☐ White, Hispanic
☐ Black, Hispanic ☐ White, Non-Hispanic
☐ Black Non-Hispanic ☐ Other
☐ Pacific Islander

12. **Marital Status.**
Mark the most appropriate category.

12. ☐ Married ☐ Separated
☐ Never Married ☐ Widowed
☐ Divorced ☐ Other

13. **Are you MALE or FEMALE?**

13. ☐ MALE ☐ FEMALE

14. **Your Age** 15. **Your Height** 16. **Your Weight**

BEFORE you fill in the response boxes write age, height, and weight at the top of the columns.

EXAMPLE:
HEIGHT = 6 feet-0 inches
(Must enter if 0 inches)

HEIGHT	
FEET	INCHES
6	0
4	■
5	1
■	2
7	3

14. AGE

YEARS	
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
	8
	9

15. HEIGHT

FEET	INCHES
4	0
5	1
6	2
7	3
	4
	5
	6
	7
	8
	9
	10
	11

16. WEIGHT

POUNDS		
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
	5	5
	6	6
	7	7
	8	8
	9	9

17. **What is your Body Frame Size?**

17.
☐ Small
☐ Medium
☐ Large

18. **How often do you do exercises that improve muscle strength, such as pushups, situps, weight lifting, a Nautilus/Universal workout, resistance training, etc...?**

18.
☐ 3 or more times a week
☐ 1 or 2 times a week
☐ Rarely or never

19. **How often do you do at least 20 minutes of non-stop aerobic activity (vigorous exercise that greatly increases your breathing and heart rate such as running, fast walking, biking, swimming, rowing, etc...)?**

19.
☐ 3 or more times a week
☐ 1 or 2 times a week
☐ Rarely or never

20. **How often do you eat high fiber foods such as whole grain breads, cereals, bran, raw fruit, or raw vegetables?**

20. ☐ At every meal
☐ Daily
☐ 3-5 days a week
☐ Less than 3 days a week
☐ Rarely or never

21. **How often do you eat foods high in saturated fats such as beef, hamburger, pork, sausage, butter, whole milk, cheese, etc...?**

21. ☐ At every meal
☐ Daily
☐ 3-5 days a week
☐ Less than 3 days a week
☐ Rarely or never

22. **Do you usually salt your food before tasting?**

22. ☐ YES ☐ NO

23 a.	CAR/TRK/VAN		,000	23 b.	MOTORCYCLE		,000
	0	0			0	0	
	1	1			1	1	
	2	2			2	2	
	3	3			3	3	
	4	4			4	4	
	5	5			5	5	
	6	6			6	6	
	7	7			7	7	
	8	8			8	8	
	9	9			9	9	

23.a. In the next 12 months how many thousands of miles will you travel by car, truck or van?

23.b. In the next 12 months how many thousands of miles will you travel by motorcycle?

NOTE: U.S. average for cars is 10,000 miles

24. ☐ Walk ☐ Sub/Compact Car ☐ Truck/Van
☐ Bike ☐ Mid or Full Car ☐ Stay at Home
☐ Motorcycle ☐ Bus/Subway/Train

24. On a typical day how do you usually travel? (Mark only one)

25.

0	1								
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

25. What percent of the time do you usually buckle your safety belt when driving or riding?

EXAMPLE: 50%

0	■	1								
5	0	1	2	3	4	■	6	7	8	9
0	■	1	2	3	4	5	6	7	8	9

26. ☐ Within 5 MPH of limit ☐ 11-15 MPH Over
☐ 6-10 MPH Over ☐ More than 15 MPH Over
☐ Don't Drive

26. On the average, how close to the speed limit do you usually drive?

27. NO. OF TIMES		28. NO. OF DRINKS	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
	6	6	6
	7	7	7
	8	8	8
	9	9	9

27. How many times in the last month did you drive or ride when the driver had perhaps too much alcohol to drink?

28. How many drinks of alcoholic beverages do you have in a typical week?

NOTE:
1 Drink = 1 glass of wine or wine cooler = 1 can of beer = 1 shot of liquor = 1 mixed drink.

EXAMPLE: 2 DRINKS

0	2
■	0
1	1
2	■

29. ☐ Yes ☐ No — **29. Have you ever felt you should cut down on your drinking?**

30. ☐ Yes ☐ No — **30. Have people ever annoyed you by criticizing your drinking?**

31. ☐ Yes ☐ No — **31. Have you ever felt bad or guilty about your drinking?**

32. ☐ Yes ☐ No — **32. Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (eye opener)?**

33. ☐ Yes ☐ No — **33. Do your friends ever worry about your drinking?**

34. ☐ Yes ☐ No — **34. Have you ever had a drinking problem?**

35. ☐ Yes ☐ No — **35. Have you ever been told that you have diabetes (or sugar diabetes)?**

36. ☐ Yes ☐ No — **36. Are you now taking medicine for high blood pressure?**

37. ☐ Daily or almost daily
☐ 3 to 5 days a week
☐ Less than 3 days a week
☐ Rarely or never

37. How often do you eat two well-balanced meals per day?

38. ☐ Daily or almost daily
☐ 3 to 5 days a week
☐ Less than 3 days a week
☐ Rarely or never

38. How often do you eat foods high in salt or sodium such as cold cuts, bacon, canned soups, potato chips, etc...?

39. ☐ Not Satisfied ☐ Somewhat Satisfied ☐ Mostly Satisfied ☐ Totally Satisfied ☐ Not Applicable

39. I am satisfied with my present job assignment and unit.

40. ☐ Money ☐ Supervisor ☐ No Problem
☐ Social Life ☐ Job
☐ Family ☐ Health

40. What causes the biggest problem in your life?

41. In the last year, how many serious personal losses or difficult problems have you had to handle (example, promotion passover, divorce/separation, legal or disciplinary action, bankruptcy, death of someone close, serious illness/injury of a loved one, etc.)?

41. ☐ Several ☐ Few ☐ Some ☐ None

42. In general, how satisfied are you with your life (e.g., work situation, social activity, accomplishing what you set out to do)?

42. ☐ Not Satisfied ☐ Somewhat Satisfied ☐ Mostly Satisfied ☐ Totally Satisfied

43. How often are there people available that you can turn to for support in bad moments or illness?

43. ☐ Never ☐ Hardly Ever ☐ Sometimes ☐ Always

44. How many hours of sleep do you usually get at night?

44. ☐ 5 Hours or less ☐ 6-8 Hours ☐ 9 Hours or more

45. Have you seriously considered suicide within the last two years?

45. ☐ Yes ☐ Yes, within the last year ☐ Yes, within the last 2 months ☐ No

46. How often do you have any serious problems dealing with your husband or wife, parents, friends or with your children?

46. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

47. How often did you experience a major pleasant change in the past year? (for example, promotion, marriage, birth, award, etc.)?

47. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

48. How often has life been so overwhelming in the last year that you seriously considered hurting yourself?

48. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

49. In the past year, how often have you experienced repeated or long periods of depression?

49. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

50. In the past year, how often have your worries interfered with your daily life?

50. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

51. How often are you able to find times to relax?

51. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

52. How often do you feel that your present work situation is putting you under too much stress?

52. ☐ Often ☐ Sometimes ☐ Seldom ☐ Never

TOBACCO USE HISTORY

53. How many cigars do you usually smoke per day?

53. ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

54. How many pipes of tobacco do you usually smoke per day?

54. ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

55. How many times per day do you usually use smokeless tobacco? (Chewing tobacco, snuff, pouches, etc.)

EXAMPLE: 20 times

0	1	■	3	4	5	6	7	8	9
■	1	2	3	4	5	6	7	8	9

55.
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

56. CIGARETTE SMOKING
How would you describe your cigarette smoking habits?

56. ☐ Never Smoked (SKIP TO QUESTION 58) ☐ Current Smoker ☐ Ex-Smoker

57. STILL SMOKE
a. How many cigarettes a day do you smoke?

USED TO SMOKE
b. How many years has it been since you smoked cigarettes fairly regularly?

c. What was the average number of cigarettes you smoked per day during the two years before you quit?

57.

a. NUMBER		b. YEARS		c. AVERAGE	
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6		6	6	6
7	7		7	7	7
8	8		8	8	8
9	9		9	9	9

58. About how long has it been since you had a rectal exam?

58. ☐ Less than 1 year ☐ 1 year ☐ 3 or more years ☐ 2 years ☐ Never

59. When was the last time you visited the dental clinic for a check-up?

59. ☐ Within the last year ☐ Between one and two years ago ☐ Over two years ago

60. [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20]

60. At what age did you have your first menstrual period?

61. [0] No Children [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45] [46] [47] [48] [49] [50]

61. How old were you when your first child was born?

62. [ ] Less than 1 year [ ] 1 year [ ] 2 years [ ] 3 or more years [ ] Never

62. How long has it been since your last breast X-ray (Mammogram)?

63. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

63. How many women in your natural family (mother and sisters only) have had breast cancer?

64. [ ] Yes [ ] No [ ] Don't know

64. Have you had a hysterectomy operation? (removal of the uterus)

65. [ ] Less than 1 year [ ] 2 years [ ] Never [ ] 1 year [ ] 3 or more years

65. How long has it been since you had a pap smear for cancer?

66. [ ] Monthly [ ] Rarely/Never [ ] Every few months

66. How often do you examine your breasts for lumps?

67. [ ] Less than 1 year [ ] 2 years [ ] Never [ ] 1 year [ ] 3 or more years

67. About how long has it been since you had your breasts examined by a physician or nurse?

MEN ONLY **MEN ONLY**

68. [ ] Less than 1 year [ ] 2 years [ ] Never [ ] 1 year [ ] 3 or more years

68. About how long has it been since you had a prostate (rectal) exam?

69. [ ] Monthly [ ] Rarely/Never [ ] Every few months

69. How often do you do a testicular (sex organs) self exam?

Questions 70 - 75 should be completed by MEDICAL PERSONNEL ONLY

70. TOTAL CHOL: [0]–[7] | [0]–[9] | [0]–[9]

71. HDL CHOL: [0]–[2] | [0]–[9] | [0]–[9]

72. 12 HR. FAST: [0]–[9] | [0]–[9] | [0]–[9]

70. Blood Lipids Total Cholesterol (mg/dl)

71. Blood Lipids HDL Cholesterol (mg/dl)

72. Blood Glucose 12 Hr. Fasting (mg %)

73. B.P.-SYSTOLIC: [0]–[3] | [0]–[9] | [0]–[9]

74. B.P.-DIASTOLIC: [0]–[2] | [0]–[9] | [0]–[9]

73. Blood Pressure (Systolic)

74. Blood Pressure (Diastolic)

75. [ ] NL [ ] ABN w/o LVH [ ] ABN w/LVH [ ] UNKNOWN

75. Most recent electrocardiogram results.

X1. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X2. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X3. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X4. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X5. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X6. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X7. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]
X8. [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

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Guarantor: Katy Benjamin
Contact: Ilyssa Hollander

A Historical Look at Alcohol Abuse trends in Army and Civilian Populations, 1980-1995

Katy L Benjamin PhD(1,2), Nicole S Bell, ScD, MPH(1), Ilyssa E Hollander, MPH(1)

Author Information:
1. **Social Sectors Development Strategies, Inc. Boston, MA**
2. **United BioSource, Inc. Medford, MA**

Corresponding Author: Ilyssa Hollander. ihollander@ssds.net. SSDS, Inc. 1411 Washington St., Suite 6. Boston, MA 02118.

Key Words: army, alcohol, hospitalization, alcohol policy, legislation

Abstract

Objectives: To compare civilian and Army alcohol-related hospitalization trends and to assess the impact of legislative and social measures in reducing these hospitalizations.

Method: We compared population-based civilian and Army annual rates of hospitalizations for overall alcohol-related diagnoses and for diagnostic subgroups of alcohol disorders (1980-1995). Direct standardization methods were used to adjust civilian data to Army age, gender and race composition. Civilian and military substance abuse regulations implemented during the study period were plotted against alcohol-related hospitalization rates.

Results: Overall alcohol hospitalization rates were similar in civilian and Army populations. Combination drug and alcohol abuse (polyabuse) rates were higher among civilians (16.6 per 10,000) than Army soldiers (5.1 per 10,000). Overall civilian and Army alcohol hospitalizations appear unaffected by legal controls, but nondependent alcohol disorders appeared responsive to regulation; in the Army, rates fell 69% between 1985 and 1995.

Conclusion: Dependent alcohol abuse appears less responsive to legislation than nondependent alcohol abuse. Military pre-enlistment screening, aggressive drug testing and zero tolerance policy may explain lower polyabuse rates. Without longitudinal, diagnosis-specific subgroup analysis these trends would not have emerged.

Introduction

Regulation of alcohol consumption presents unique challenges. Unlike non-prescription drugs, alcohol is not an illegal substance. It is a commodity with strong links to social structures, and may provide health benefits if consumed in moderation.[1-6] Thus, the challenge has been to control the consumption and reduce the negative consequences of alcohol without banning it outright.

In recent decades, federal and state initiatives to reduce the prevalence and consequences of alcohol abuse have increased. The Armed Forces have instituted similar measures (Figure 1). Results of regulatory efforts to reduce alcohol consumption and its adverse consequences have been mixed.

While there have been overall declines in per capita sales of alcoholic beverages[7, 8] and fewer alcohol-related traffic fatalities,[9, 10] other consequences of alcohol abuse, including work problems, difficulties with personal relationships, legal or health problems were almost unchanged between 1984 and 1995.[11] Similarly, although raising the price of alcohol through excise taxes has reduced overall consumption, there is some evidence that heaviest drinkers are least affected by interventions.[12-17] The relative proportions of light drinking and alcohol abstention have risen in both military and civilian populations,[7, 18, 19] but the prevalence of episodic heavy drinking and binge drinking has not significantly decreased.[19-21]

It is difficult to assess the influence of alcohol regulations on consumption because consumption patterns may be influenced by changes in the economy or social perceptions about drinking,.[22-24] and shifting social norms may affect perceptions and decisions about alcohol consumption.[3, 17, 25, 26] Furthermore, policies may reduce negative alcohol-related behaviors,

such as traffic crashes and fatalities, without changing underlying consumption patterns.[27] Environmental changes also influence risk for adverse drinking-related outcomes. For example, recent reductions in traffic fatalities may in part reflect improved environmental and vehicle safety features or increased seat belt usage.[28, 29]

Study limitations also make it difficult to assess the influence of alcohol policies and regulation targeting unhealthy alcohol consumption and alcohol-related problems. Many civilian longitudinal studies were based on few data points (sometimes only two), with long periods between observations. [19, 21,25, 26, 30, 31] Thus, intervening factors that may occur over time make attribution of alcohol-related problems to specific types of legislation difficult.

Army personnel are subject to both Department of Defense (DoD) and civilian substance abuse regulations. Military and civilian comparisons are useful because effects of both general population and additional military restrictions on drinking behavior and consequences can be assessed.[32, 33] Examining these trend differences may reveal the effectiveness of specific military regulations as well as general civilian social legislation.

Several studies have compared alcohol consumption patterns between military and civilian populations but sometimes it is difficult to draw conclusions because of variations in the study designs. In addition, because most studies rely on cross-sectional data, they focus on self-reported alcohol use per se without linking use to actual alcohol-related health outcomes. Polich (1981) compared military and civilian rates of self-reported dependent and nondependent alcohol abuse.[34] However, direct comparison was difficult because the cross-sectional data came from several different surveys, given at different times to different groups over an 8-year period. Ballweg and Li (1989) compared military and civilian self-reported health habits from two different 1985 surveys, but the results were not directly comparable due to different definitions

of alcohol consumption levels.[35] Bray et al (1991) compared military and civilian self-reported alcohol consumption rates.[32] However, data were collected from two different instruments, limiting interpretability. Respondents were unidentifiable, making it difficult to assess the predictive validity of the items. The self-report nature of data used in these studies implies that results may be subject to recall or other forms of inherent bias.

This study examines longitudinal trends in alcohol-related hospitalizations, comparing population-based rates for active-duty U.S. Army personnel to civilian rates. These trends were evaluated against military and civilian regulations enacted during the study period in order to assess their effects over time. In addition to analyzing trends in overall alcohol-related hospitalizations, trends for three diagnostic subgroups of alcohol abuse were evaluated: alcohol dependence, nondependent alcohol abuse, and concurrent alcohol and drug problems ("polyabuse"). These groups represent three distinct types of problem drinking, and may be differentially affected by alcohol regulations. Alcohol-dependent individuals are addicted to alcohol, exhibiting physical dependence on and increased tolerance for alcohol. They cannot control their drinking, often deviate from social norms in the amount they consume and the circumstances under which they drink, and may be less influenced by drinking regulations than those who abuse alcohol without being addicted. Nondependent alcohol abusers engage in the excessive consumption of alcohol, such as binge drinking, excessive drinking, or drinking in high risk situations, but do not exhibit the chronic, uncontrolled drinking behaviors of dependent alcoholics.[36] Little is known about differential responsiveness to social controls for diagnostic subgroups of alcohol abusers.

Effects of social control legislation on polyabusers are also unclear. Some have observed a "substitution effect" where the use of one substance increases as another is restricted;[37, 38]

others have found that regulation of one substance decreases the use of both substances ("complementary effect").[39, 40] An examination of hospitalization patterns for concurrent drug and alcohol abuse in relation to drug-or alcohol-specific regulations may clarify this.

Methods

Data Sources:

Army hospitalization and demographic information was obtained from the Total Army Injury and Health Outcomes Database (TAIHOD).[41, 42] Encrypted Social Security Numbers are used to link records from DoD administrative and health data sources, including inpatient hospitalization data originating in the Army's Individual Patient Data System.

Civilian cases were obtained from the National Hospital Discharge Survey.[43] Conducted annually by the U.S. National Center for Health Statistics (NCHS), this survey collects information from discharge abstracts of a nation-wide sample of non-federal, short-term (average length of stay < 30 days) hospitals with $\geq$ 6 beds. Discharges are sampled randomly from each selected hospital. Sampling weights provided by NCHS were used to compute national estimates of hospitalizations within specific diagnostic categories and by selected demographic subgroups.[44]

Alcohol-related diagnoses occurring between 1980 and 1995 were identified using the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM). As the study years spanned two ICD versions, a crosswalk analysis was performed to ensure all relevant diagnostic groups were comparable over the study period. No major differences in alcohol-related diagnostic codes employed by civilian hospitals were noted, but several different alcohol codes were used by the Army during the early study period. From 1980-1985 the Army used a unique code (305.4) to denote nondependent alcohol abuse without concomitant drug abuse; in

civilian hospitals, this code indicated “nondependent barbiturate and similarly acting sedative or hypnotic abuse.” From 1980-1988, several Army-specific codes were created to identify concurrent alcohol and drug abuse, some without indication of whether the alcohol-related condition was dependent or nondependent. These polyabuse codes were not used by civilian hospitals during this time period, nor do they appear in Army hospital records after 1988. Therefore, in order to compare diagnostic trends over time and between Army and civilian populations, a category for all hospitalizations containing both drug and alcohol abuse diagnoses was created and applied to both Army and civilian hospital data for all years of the study period.

The case definition for alcohol-related hospitalizations diagnoses were grouped as follows: 1) nondependent alcohol abuse, 2) dependent alcohol abuse, 3) alcohol psychosis, 4) cirrhosis and liver disease, 5) polyabuse conditions and 6) other alcohol conditions (e.g. poisoning effects of alcohol deterrents or excessive blood levels of alcohol). ICD-9-CM diagnoses used for case identification are presented in Table 1.

{INSERT TABLE 1}

The 1980-1995 timeframe was chosen because an increase in managed care in both the Army and civilian medical systems in the mid-1990s resulted in a shift in treatment of alcohol problems from an inpatient to outpatient settings.[45,46] All hospitalizations between 1980 and 1995 with an alcohol diagnosis (in the primary or secondary positions) were included for analysis. The overall prevalence of alcohol-related hospitalizations was based upon number of hospitalizations, and not number of diagnoses. To avoid double counting, cases with more than one alcohol-related diagnosis per record were counted once to assess the total number of alcohol-related hospitalizations. However, cases with more than one alcohol diagnosis were included in

all relevant diagnostic subgroup analyses. Therefore, total hospitalizations for all diagnostic subgroups combined exceed the number of total alcohol-related hospitalizations overall. The only exception to this is the polyabuse group where, for reasons stated above, any hospitalization with multiple substance abuse codes was considered a polyabuse case only.

Comparisons of Army and civilian alcohol-related hospitalization rates were made by directly standardizing civilian data to the Army's age, gender and racial characteristics. Only civilian cases between the ages of 17-55 were included in order to maintain parity with the Army population.[18]

A literature search of substance abuse-related laws and regulations from 1980 to 1995 was conducted. Analyses focused primarily on federal legislation and federal incentives enacted at the state level, such as minimum legal drinking age laws, as both Army and civilian populations were uniformly affected by these efforts. Relevant Army-specific regulations enacted during this time were included in the analysis.

Analyses were conducted using SAS version 8.1.[47]

Results

Overall rates of alcohol-related hospitalizations

Army and civilian overall alcohol-related hospitalization rates were similar across most of the study period. The average Army rate was 61.8 per 10,000 population (Range: 52.6 to 76.0 per 10,000). The average adjusted civilian rate was 60.4 per 10,000 (Range: 55.4 to 70.5 per 10,000). Both Army and civilian alcohol-related hospitalization rates increased during the mid-1980s, although the increase was somewhat steeper and of longer duration for the Army. By 1988 rates for both military and civilian populations began to fall but Army rates declined more

consistently, and by 1991, overall alcohol-related hospitalization rates were virtually identical (Figure 1).

Plotting these trend lines against federal and DoD-specific substance abuse legislation, and against indicators of anti-substance abuse social movements such as Mothers Against Drunk Driving, it is difficult to discern any shift in short-term trends in the civilian population. The increase in alcohol-related hospitalizations observed among Army personnel begins around 1984, just after DoD drunk driving regulations were enacted and about the time the DoD Directive 1010.1 mandated drug testing of recruits and other, selected Army personnel (Figure 1).

{INSERT FIGURE 1 HERE}

Hospitalization rates for specific types of alcohol-related diagnoses

Alcohol dependence diagnosis rates dipped in 1985 for the civilian population but even more so for the Army. This was the same year that Public Law 99-145 was enacted, mandating the minimum legal drinking age (MLDA) of all Army installations correlate with the MLDA of the state containing, or within 50 miles of, the installation. Between 1986 and 1988, Army alcohol-dependent hospitalization rates rose from 26.9 cases to 35.0 cases per 10,000. Adjusted rates among civilians dropped from approximately 37 cases per 10,000 in 1986 to 27 cases per 10,000 in 1988, continuing to fall until 1995 (Figure 2).

{INSERT FIGURE 2}

On average, Army hospitalization rates with nondependent alcohol diagnoses were higher than civilian rates, averaging 21.0 per 10,000, compared to an adjusted civilian rate of 7.6 hospitalizations per 10,000 (Figure 3). Army rates fluctuated widely, ranging from 36.4 cases per 10,000 in 1985 to 11.4 per 10,000 in 1995. Between 1984 and 1985, rates of Army nondependent alcohol-related hospitalizations increased by 80%, from 20.3 to 36.4 per 10,000, remaining much higher than civilian rates until 1988 when they gradually declined, approaching civilian levels by 1993. This dramatic increase coincides with the 1984 DoD directive on mandatory drug testing and with the 1984 Uniform Age Drinking Act which, in conjunction with Public Law 99-145 of 1985, ultimately increased the MLDA for Army soldiers. Army rates for nondependent abuse then consistently decreased beginning in 1988 coinciding with the date when all states had raised the MLDA to 21. In contrast, the civilian nondependent alcohol-

related hospitalizations rate increased slowly but consistently from 4.7 per 10,000 in 1982 to 10.8 per 10,000 in 1994.

{INSERT FIGURE 3}

Rates of Army polyabuse hospitalizations were generally lower than civilian rates and were almost completely unchanged throughout the study period, averaging about 5 cases per 10,000. Civilian polyabuse hospitalization rates increased consistently from 6.2 per 10,000 in 1980 to 28.7 per 10,000 in 1995. Virtually identical in 1980, by 1995 polyabuse hospitalization rates for civilians were almost 6 times greater than Army rates (Figure 4).

{INSERT FIGURE 4}

Discussion

Alcohol-Related Hospitalization Rates among Army and Civilian Populations

Army and civilian overall alcohol hospitalization rates were similar throughout the study period. However, this finding obscures differences in rates for specific types of alcohol abuse. Hospitalization rates for alcohol dependence, initially lower for Army populations, increased in the late 1980s, remaining higher than civilian rates. In later years, Army rates for alcohol dependence hospitalizations stabilized somewhat, while civilian rates steadily declined, possibly due to the managed care-driven shift to

outpatient services in civilian healthcare[48-50] and increasing restrictions on access to substance abuse treatment for uninsured civilians.[51]

The divergent hospitalization rates for nondependent alcohol disorders during the mid-1980s are particularly striking. While civilian hospitalization rates for nondependent alcohol abuse showed a slight, gradual rise over time, Army rates were more volatile. Averaging more than double the civilian rate for nondependent alcohol hospitalizations between 1980-1983, Army rates jumped to an average of four times that of civilians between 1984-1988. The steepest rise and peak occurred from 1985 to 1987, before falling close to civilian levels by 1992. This may be a reaction to the 1984 DoD mandatory drug-testing regulation. In response, Army recreational drug users may have reduced consumption of illicit substances, drinking larger amount of alcohol instead. Such a “substitution effect” was observed in a study of the California MLDA, where there was a concomitant decline in alcohol consumption and a rise in marijuana use among high school seniors.[37] Bray et al. also postulated a substitution effect to explain the upsurge in self-reported heavy drinking in the U.S. Army during this period.[18] As drug abusers were weeded out of the Army over time, this substitution effect would have waned, resulting in the observed decline in nondependent alcohol admissions.

Another explanation of these comparatively high rates of nondependent alcohol abuse within the Army is the heightened vigilance within the military to detect alcohol abuse, especially nondependent abuse. These events typically involve acute intoxication which may be easier to identify than alcohol dependence since dependence may be diagnosed even if the patient is not acutely intoxicated. DoD-specific codes for

nondependent alcohol abuse suggest that this condition was of particular

interest to the Army. Moreover, increased civilian social action to curtail and punish underage drinking and raise the MLDA would have equally impacted the detection of drinking among Army soldiers.

The rise of nondependent alcohol abuse hospitalizations among Army soldiers was followed by a consistent decline in hospitalization rates. Such a decrease coincides with the nationwide increase in the MLDA to 21. It may also reflect greater social control and awareness within the Army.

While civilian rates of polyabuse hospitalizations climbed steadily over the study period, Army rates remained low and almost unchanged. Possibly, polyabusers were less likely to enter the military by choice or due to pre-screening practices. It is unclear why civilian polyabuse hospitalization rates rose steeply in the mid-1980s and continued to climb. National data suggest that while drug use rates fell over this time period drug-related emergency room visits rose.[52] Increased medical intervention was possibly due to increased strength or toxicity in illicit drugs, rather than an increase in drug use. While several studies have evaluated the prevalence of polyabuse, they have been limited by small subpopulations[53, 54] or they did not evaluate trends over time.[55-57] Our findings call for more research to understand factors associated with a rapidly accelerating rate of multiple substance abuse in the civilian population.

Efficacy of Policy and Regulation

Little evidence linked changes in major federal and DoD policies to changes in total alcohol-related hospitalization rates overall, suggesting that policies and regulations may have only marginal effects on some serious consequences of drinking. While

alcohol consumption and its negative consequences have decreased since the 1980s, [7, 8, 26, 58, 59] serious alcohol abuse might be more recalcitrant to legal change efforts in civilian and military settings.[20, 25, 32] Some researchers have speculated that anti-alcohol actions and interventions over the years have resulted in lower a threshold for qualifying as a "problem" drinker and an increased likelihood that such individuals will be recognized as needing help.[25, 26] While this may hold true for self-reported alcohol problems, hospital rates for alcohol problems have not changed appreciably in the past 20 years.[60]

Social legislation may be more successful in controlling some types of alcohol-related behaviors and problems than others. Many reports have focused upon decreases in drunk driving and drunk driving fatalities among civilians[29, 61, 62] without evaluating changes in other consumption indicators. Wagenaar found that, while the frequency of driving after consuming more than 5 drinks fell significantly in relation to laws that lowered allowable blood alcohol levels, overall drinking amount was unaffected.[27]

Army alcohol-related hospitalizations did decline, suggesting some responsiveness to regulations in terms of overall alcohol problems and specifically for nondependent alcohol abuse. For both diagnostic categories, once rates peaked, they declined steadily thereafter indicating that some social control measures specific to the Army may have helped curtail and control certain types of abuse. Although an association between policy and nondependent alcohol abuse rates was observed, there was little evidence of an association between alcohol policy and alcohol dependence hospitalizations. This underscores the difficulty in using social control methods to reduce severe health consequences among chronic alcohol abusers in both military and civilian settings.

Strengths and Limitations

The ability to study a large, nationally-representative sample of Army and civilian hospitalizations is a considerable advantage over other studies limited to specific groups.[17, 19, 21, 37, 58, 63] The TAIHOD also offered the ability to standardize rates for differences in the age, gender, and racial composition of Army and civilian populations unlike the previous comparative study by Ballweg and Li (1989). The longitudinal nature of data allowed for analyses of long-term trends in alcohol abuse, as opposed to cross-sectional studies or those with limited data points.[19, 21, 25, 26, 30, 31] Also, unlike studies that rely upon self-report to estimate prevalence of substance abuse,[7, 18, 20, 21, 30-33, 64] this study relied upon alcohol-related hospitalizations. Alcohol-related health events, though indirectly related to alcohol consumption patterns, may be a more objective measure of abuse. Given that respondents have been found to underestimate consumption by around 25%,[34] hospitalizations may be a more reliable indicator of severe alcohol problems. Furthermore, most self-report measures of alcohol abuse characterize abuse by number of drinks consumed and patterns of consumption, which may or may not translate into diagnosable conditions. Medical treatment costs for alcohol-related health problems are costly.[15, 65, 66] Studying serious and expensive alcohol-related conditions is important to identify strategies that will reduce societal costs and improve quality of life.

Study limitations include the inability to account for temporal or population-based differences in the interpretation of substance abuse diagnostic criteria. Societal norms defining problem drinking or abuse and their influence on the prevalence of alcohol-related disease diagnoses are unknown. Also, the prevalence of hospitalized cases should

not be confused with the prevalence of alcohol-related disorders in the population as a whole; under-diagnosis of these conditions is common,[67] and does not appear to have improved over time.[60] Patterns of severe alcohol abuse in undiagnosed cases may differ from the hospitalized cases observed herein.

Laws enacted at the state or local level during the study period were not included. Additionally, changes in MLDA laws occurred over a period of time and varied by state. We were also unable to account for the plethora of public educational interventions that were instigated at the time. Thus, the effect of these activities on alcohol-related hospitalization rates is unknown and the cumulative effect of the many legal and educational efforts on the prevalence of alcohol-related conditions was not evaluated.

Conclusion

This research provides a detailed overview of changes in the prevalence of alcohol-related disorders over time in relation to federal and military-specific anti-substance abuse legislation. It is enhanced by the ability to compare two populations subject to similar, but not identical, regulations and social controls. This study demonstrates the importance of evaluating effects of legislation in an extended longitudinal framework. Without adequate data points, for example, the spike and subsequent drop in nondependent alcohol abuse hospitalizations might not have been observed, possibly leading to erroneous conclusions about the effects of substance abuse policies. Our findings also highlight the importance of subgroup analysis. Had we only examined overall rates of alcohol-related hospitalizations, differences in dependent and

nondependent alcohol cases would not have been observed, and an opportunity to better understand and craft diagnosis-specific policies and interventions would be lost.

This study supports other evidence indicating that dependent alcoholics have not been as responsive to legal measures as those with nondependent abusive drinking habits, suggesting that different types of alcohol abusers may respond differently to behavioral regulatory attempts. Dependent alcoholics and nondependent alcohol abusers are especially important to reach with effective interventions, as they are both at-risk for poor outcomes. Research focused on effective strategies to reduce consumption and minimize consequences of alcohol use and abuse in these populations is urgently needed. Army screening and intervention initiatives should be designed with an awareness of these trends and varying levels of responsiveness.

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Table 1. Diagnostic codes for identification of alcohol-related hospitalizations as they appear in the ICD-9-CM.

Category	Classification in ICD-9-CM
Alcoholic psychoses	291.0 Alcohol withdrawal delirium
	291.1 Alcohol amnestic syndrome
	291.2 Other alcoholic dementia
	291.3 Alcohol withdrawal hallucinosis
	291.4 Idiosyncratic alcohol intoxication
	291.5 Alcoholic jealousy
	291.8 Other specified alcoholic psychosis
	291.81 Alcohol withdrawal
	291.89 Alcohol psychosis—Other
	291.9 Unspecified alcoholic psychosis
Alcohol dependence syndrome	303.0 Acute alcoholic intoxication
	303.00 Acute alcoholic intoxication—Unspecified
	303.01 Acute alcoholic intoxication—Continuous
	303.02 Acute alcoholic intoxication—Episodic
	303.03 Acute alcoholic intoxication—In remission
	303.9 Other and unspecified alcohol dependence
	303.90 Other and unspecified alcohol dependence—Unspecified
	303.91 Other and unspecified alcohol dependence—Continuous
	303.92 Other and unspecified alcohol dependence—Episodic
	303.93 Other and unspecified alcohol dependence—In remission
	357.5 Alcoholic polyneuropathy
	425.5 Alcoholic cardiomyopathy
	535.3 Alcoholic gastritis
	535.30 Alcohol gastritis without mention of hemorrhage
	535.31 Alcohol gastritis with hemorrhage
Nondependent abuse of alcohol	305.00 Alcohol abuse—Unspecified
	305.01 Alcohol abuse—Continuous
	305.02 Alcohol abuse—Episodic
	305.03 Alcohol abuse—In remission
Chronic liver disease and cirrhosis	571.0 Alcoholic fatty liver
	571.1 Acute alcoholic hepatitis
	571.2 Alcoholic cirrhosis of liver
	571.3 Alcoholic liver damage, unspecified
	571.5 Cirrhosis of liver without mention of alcohol
	571.6 Biliary Cirrhosis
	571.8 Other chronic nonalcoholic liver disease

	571.9 Unspecified chronic liver disease without mention of alcohol
Other conditions	760.71 Alcohol affecting fetus via placenta or breast milk
	790.3 Excessive blood level of alcohol
	977.3 Poisoning by alcohol deterrents
	980.0 Toxic effect of ethyl alcohol
	980.1 Toxic effect of methyl alcohol
	980.2 Toxic effect of isopropyl alcohol
	980.8 Toxic effect of other specified alcohols
	980.9 Toxic effect of unspecified alcohol
	V11.3 Personal history of alcoholism
	V79.1 Screening for alcoholism
	E947.3 Adverse effects of alcohol deterrents
Polyabuse – Alcohol with drug[1]	304.0 - Drug dependence-opioid type dependence
	304.1 - Drug dependence- barbiturate or similarly acting sedative or hypnotic type dependence
	304.2 - Drug dependence-cocaine dependence
	304.3 - Drug dependence-cannabis dependence
	304.4 - Drug dependence-amphetamine and other psychostimulant dependence
	304.5 - Drug dependence-hallucinogen dependence
	304.6 - Drug dependence-other specified drug dependence
	304.7 - Drug dependence-combinations of opioid type drug with any other
	304.8 - Drug dependence-combinations of drug dependence excluding opioid type drug
	304.9 - Drug dependence-unspecified drug dependence
	305.2 – Nondependent abuse of drugs-cannabis abuse
	305.3 – Nondependent abuse of drugs-hallucinogen abuse
	305.4 – Nondependent abuse of drugs-barbiturate and similarly acting sedative or hypnotic abuse
	305.5 – Nondependent abuse of drugs-opioid abuse
	305.6 – Nondependent abuse of drugs-cocaine abuse
	305.7 – Nondependent abuse of drugs-amphetamine or related acting sympathomimetic abuse
	305.8 – Nondependent abuse of drugs-antidepressant type abuse
	305.9 – Nondependent abuse of drugs-other, mixed, or unspecified drug abuse

1. When any of the drug diagnoses appear in the same hospital record as any of the above alcohol diagnoses, the case is considered exclusively a polyabuse case. This was necessary in order to accommodate changes in polyabuse coding over the study period. Details regarding changes in alcohol and drug abuse coding in the Army are available upon request to the author.

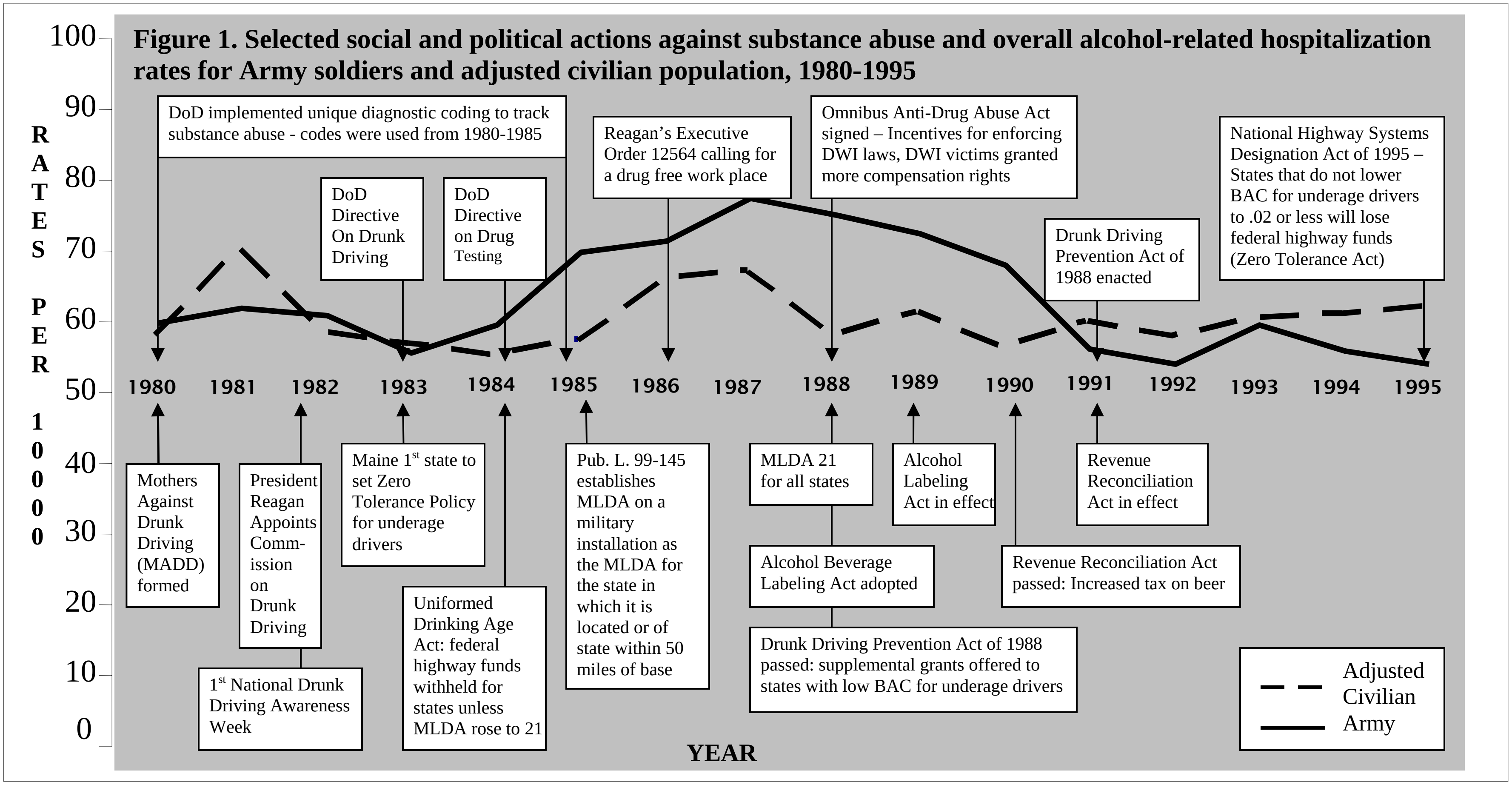
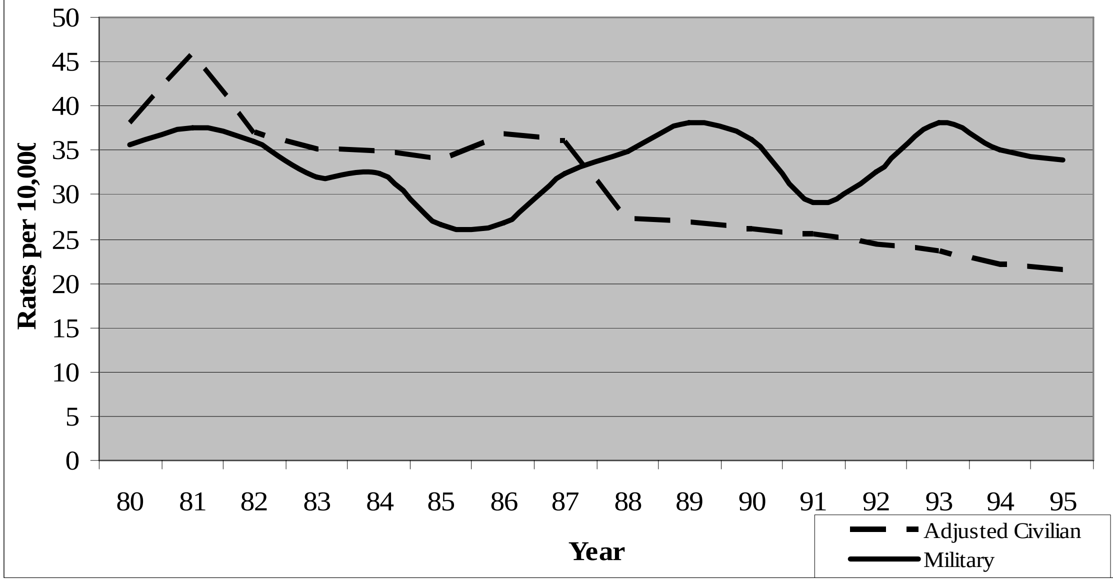


Figure 1. Selected social and political actions against substance abuse and overall alcohol-related hospitalization rates for Army soldiers and adjusted civilian population, 1980-1995

Figure 2. Rates of Hospitalizations with Dependent Alcohol Abuse for the U.S. Army and Civilian Populations, 1980-1995, Ages 17-55, Civilian Adjusted to Army Population for Age, Race and Gender



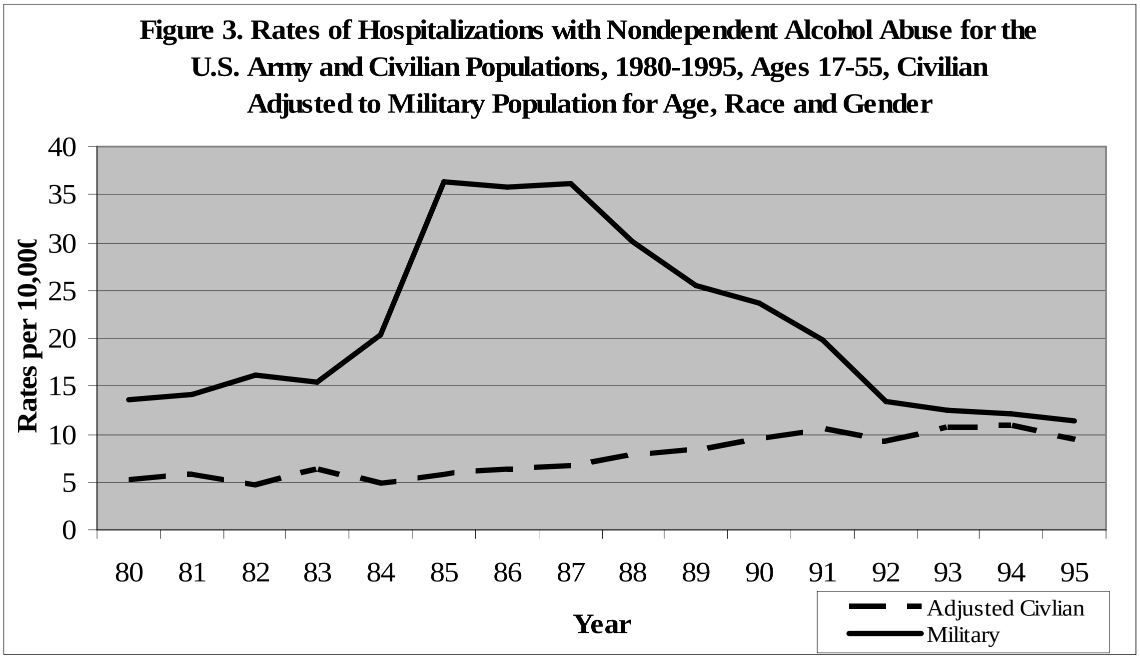
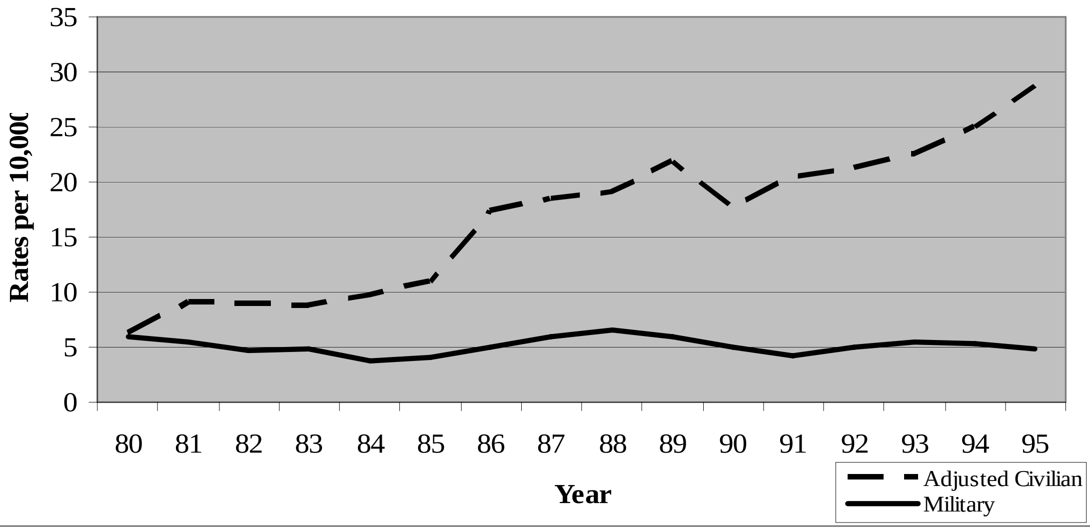


Figure 3. Rates of Hospitalizations with Nondependent Alcohol Abuse for the U.S. Army and Civilian Populations, 1980-1995, Ages 17-55, Civilian Adjusted to Military Population for Age, Race and Gender
Rates per 10,000
40
35
30
25
20
15
10
5
0
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
Year
Adjusted Civlian
Military

Figure 4. Rates of Hospitalizations with Polyabuse for the U.S. Army and Civilian Populations, 1980-1995, Ages 17-55, Civilian Adjusted to Army Population for Age, Race and Gender



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A DESCRIPTIVE STUDY OF U.S. ARMY SOLDIERS REFERRED TO, EVALUATED BY, AND ENROLLED IN THE ARMY SUBSTANCE ABUSE PROGRAM, 1988-2003

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Ilyssa E. Hollander, Nicole S. Bell, Margaret Phillips, Paul J. Amoroso, Les MacFarling

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Social Sectors Development Strategies, Inc.
1411 Washington St. Suite 6
Boston, MA 02118

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9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
US Army Research Institute of Environmental Medicine
Kansas St., Building 42
Natick, MA 01760-5007

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Soldiers were more likely to self-refer, to be medically-referred family-referred. Hispanics and no-longer-married Soldiers were both more likely to be referred for evaluation following a DUI charge. Those initially self-referred were likely to enroll after a subsequent evaluation. Eventual enrollments among Soldiers originally sent to prevention training suggest that the current alcohol/drug abuse prevention training curriculum should either be revised or implemented more aggressively, or the screening process reviewed. Findings should be applied to increase both the sensitivity and specificity of ASAP screening techniques and to improve upon both prevention training and alcohol treatment.ning suggest that the current alcohol and other drug abuse prevention training curriculum should either be revised or implemented more aggressively, or the screening process reviewed to determine whether a more rigorous standard should be applied in determining whether an individual should be enrolled in a more formal treatment program. Findings should be applied to increase both the sensitivity and specificity of screening techniques and to improve upon both prevention training and alcohol treatment.

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Ilyssa E. Hollander
Nicole S. Bell
Margaret Phillips
Paul J. Amoroso
Les MacFarling

Military Performance Division

September 2006

U.S. Army Research Institute of Environmental Medicine
Natick, MA 01760-5007

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LIST OF ACRONYMS

ADAPCP	Alcohol and Drug Abuse Prevention and Control Program
ADAPT	Alcohol and other Drug Abuse Prevention Training
ASAP	Army Substance Abuse Program (formerly ADAPCP)
CCC	Community Counseling Center
DAMIS	Drug and Alcohol Management Information System
DMDC	Defense Manpower Data Center
DUI	Driving while Under the Influence
MLDA	Minimum Legal Drinking Age
OR	Odds Ratio
TAIHOD	Total Army Injury and Health Outcomes Database

EXECUTIVE SUMMARY

Alcohol abuse is a major concern in the U.S. military, since the use of alcohol is associated with a myriad of adverse outcomes that can affect both individual and collective health and performance of Soldiers. The U.S. Army Substance Abuse Program (ASAP) provides evaluation and treatment services for drug and alcohol abusers within the Armed Forces. ASAP is designed to identify and treat Soldiers with the potential to recover, and therefore the ability to further contribute to the military. Little has been published describing the characteristics of Soldiers referred for alcohol evaluation and enrolled in ASAP for treatment of an alcohol abuse problem.

This report describes the demographic and occupational characteristics of Soldiers referred to ASAP for an alcohol abuse evaluation by linking ASAP data to Army personnel data. Details regarding ASAP referral mechanism (i.e. medical referrals, referral following a legal investigation, self referrals) are explored. In some cases Soldiers referred to ASAP are not enrolled for treatment; these special cases are investigated.

We found that Soldiers who were single, young, male, of lower rank, of lower education, in the infantry and not black are overrepresented among alcohol referrals. Commanders and physicians should therefore be aware of these characteristics when identifying Soldiers who abuse alcohol, but also keep in mind that alcohol abuse crosses all demographic boundaries. Additionally, different referral processes seem to reach different demographic subgroups of the population. Males were much more likely than females to be referred for evaluation as a result of an investigation, and were also more likely to be referred as a result of drinking under the influence (DUI). Female Soldiers were more likely to self-refer, to have a medical referral, or be referred by family. Hispanics and no-longer-married Soldiers were both more likely than others to be referred to ASAP for evaluation following a DUI charge. This information should be applied to increase both the sensitivity and specificity of screening techniques.

Given the fact that ASAP is designed specifically to enroll Soldiers who may be rehabilitated and returned to duty, there are some areas where the program could improve. High re-enrollment rates among the self-referred can be used to reassess the ASAP counselor or Commander's approach to treating self-referring Soldiers. Treating these individuals sooner may expedite rehabilitation and a more productive return to duty. The eventual enrollments among Soldiers originally referred for prevention training suggest that the current alcohol and other drug abuse prevention training curriculum should either be revised or implemented more aggressively, or the screening process reviewed to determine whether a more rigorous standard should be applied in determining whether an individual should be enrolled in a more formal treatment program.

INTRODUCTION

Alcohol abuse is the third most common preventable cause of death in the U.S. according to the Centers for Disease Control (1). Its association with increased risk of injuries and a number of other physical and mental health conditions and social problems has been well-documented (17, 18, 29, 30, 32, 33, 44, 45).

In the U.S. military, alcohol abuse is of special concern for two main reasons. First, it is more common among active duty Army Soldiers than among their civilian peers (12, 25). Second, it poses a potential threat not only to the health of individual service members--it has been linked to a wide range of adverse outcomes including drowning (7), motor vehicle injury (8), falls (43), early discharge from the Army (31), and perpetration of spouse abuse (9, 15)--but also to the readiness of the military overall (12, 50, 51).

The military recognizes that alcohol abuse can have a negative impact on the health and readiness of the armed forces and that such abuse is preventable. Therefore, all military personnel are required to attend 4 hours of basic alcohol and drug prevention education services each year (24). This training focuses on informing Soldiers about the negative consequences of alcohol abuse and offering information on local substance abuse programs. In addition to this service-wide educational intervention, Soldiers may be either referred to or may voluntarily join the more formal alcohol and other drug abuse prevention training (ADAPT) program. Soldiers in the ADAPT education program receive no fewer than 12 hours of prevention training, the main focus of which is on educating Soldiers about the consequences of substance abuse (24).

Despite these prevention and educational campaigns to deter abusive alcohol use, some Soldiers still engage in unhealthy drinking behaviors or develop alcohol-related problems. In response, the Army established the Army Substance Abuse Program (ASAP), formerly the U.S Army Alcohol and Drug Abuse Prevention and Control Program (ADAPCP). This program, developed in 1971, screens referred Soldiers for drug and/or alcohol abuse and provides or manages alcohol treatment when appropriate. It operates in Army bases around the globe at the local installation level with screening and treatment information sent to a central repository agency in Alexandria, Virginia for record keeping.

There are a number of ways in which an individual with a substance abuse problem might be identified, referred for evaluation, and ultimately treated for this condition. Some of these avenues are similar to those that have been studied and described in the civilian population, including medical referrals through a primary care health provider (6, 20) or hospital and emergency room personnel (19, 40, 46), legal intervention, and self- and family-referral (5, 10, 48, 49). In addition to these routes, there are additional mechanisms for referral in the Army. Commanders and supervisors may request targeted screening of individuals and sometimes entire Army units.

Impetus for screening may include suspicious behavior or misconduct. Soldiers may also be referred for an alcohol abuse evaluation, as part of routine security clearances, or following a citation, on- or off-post, for driving under the influence of alcohol (DUI).

In civilian populations, referral procedures have been shown to relate to characteristics of the individuals being referred for evaluation and/or treatment. Yu et al. (2004) found that alcoholic Hispanic men were more likely than alcoholic white and black men to be referred for treatment through a medical care process (52). Boscarino (1980) found that among patients in alcoholic treatment centers, those referred through legal or criminal intervention were younger and more likely to be male, while those who self-referred were older and more likely to be black, and those referred by family members were older and more likely to be female and black (10). These findings, however, were based on aggregate demographic data from alcohol treatment centers rather than on individual characteristics according to source of referral. Demographic characteristics of Army Soldiers referred to alcohol evaluation and treatment have not been well studied. The experience in civilian populations, the nature of military incentive structures, and the existence of additional referral mechanisms in the Army suggest that there may be important variations that should be documented in order to better serve subpopulations of Soldiers at risk and to identify possible gaps in the system.

There are also reasons to believe that different referral routes will affect the likelihood of enrollment in Army treatment programs, as well as the likelihood of success once enrolled. Weisner et al*.* (2002) showed that among samples of insured and uninsured civilians with alcohol problems, criminal justice referrals were significantly and positively related to entering an alcohol treatment program. Among the insured population only, both workplace and family pressure had a significant impact on the decision to enter a treatment program (49). Atkinson et al*.* (2003) found that for males over 55 years of age, legal intervention was a stronger impetus for completing alcohol treatment than self-referral, family referrals, or referral by health or social services (5).

While there are a few studies that explore the efficacy of the Army alcohol and drug treatment program (28, 35, 41, 47), there are no comprehensive studies that have examined in detail the process of referral and enrollment, nor the characteristics of the individuals referred to and treated in the ASAP. Such information should be gathered and used to improve the design of intervention strategies to combat the important problem of alcohol abuse in the U.S. military.

The objective of this study is to address the gap in information about referral and enrollment in the Army's alcohol abuse treatment program. It offers a comprehensive look at the demographic characteristics of Soldiers evaluated for alcohol abuse, the source of their referral, and the probability and outcome of enrollment in the Army's substance abuse program.

THE ARMY SUBSTANCE ABUSE PROGRAM (ASAP)

In the current ASAP system, once a Soldier is referred for an alcohol evaluation, a Rehabilitation Team is assigned to determine whether enrollment in the alcohol treatment program is warranted. This team consists of ASAP professionals, medical doctors, and the Soldier’s Commander. Only Soldiers determined to have a good chance of successfully completing treatment, recovering, and returning to duty are considered eligible for enrollment. According to Army Regulations 600-85, “the unit commander should recommend enrollment based on the Soldier’s potential for continued military service in terms of professional skills, behavior, and potential for advancement” (24). The Commander plays an important role in determining whether a Soldier will be enrolled for treatment. In addition, the Commander’s opinion is also considered by the ASAP counselor in determining whether a Soldier is retained in a treatment program. Thus, referral and program success are partially mediated by occupational performance.

Soldiers are enrolled in ASAP treatment when the counselor/evaluator determines the individual has a pattern of substance abuse that requires more than a limited prevention-related educational intervention. Treatment generally occurs in an outpatient facility in either individual or group therapy settings depending upon availability of services at a given military installation. If there is no substance abuse facility on base, a Soldier is sent to the closest Army facility on a different base. Outpatient treatment is conducted at Army ASAP Community Counseling Centers (CCCs), though Soldiers may also attend civilian programs such as Alcoholics Anonymous. Treatment is designed to be short-term. However, the actual length of treatment ranges from a minimum of 90 days to a maximum of 365 days. Treatment length varies depending on the needs of the individual Soldier and based on recommendation by the ASAP counselor and the Soldier’s Commander. The Army’s ADAPT educational program may also be included as part of a Soldier’s treatment. ADAPT does not have a set curricula and varies by installation. ADAPT programs must be at least 12 hours and must be completed within 30 days. At any time during or after the ADAPT prevention training, a Soldier may self-enroll or be referred for enrollment in a more formal alcohol treatment program. Before September 1988, this change in status may not have been recorded in the alcohol treatment data. However, since September 1988, a change in status from ADAPT training to alcohol treatment enrollment would be accompanied by a new ASAP evaluation record and the new enrollment status noted.

Once enrolled for alcohol treatment, a Soldier is required to attend follow-up evaluation sessions (varying in number and frequency depending on the situation) with trained counselors in order to assess the efficacy of the treatment program. Soldiers who fail to complete an Army alcohol treatment program are rarely given a second chance. Army regulations indicate that only in extreme or special circumstances would a Soldier be re-enrolled in ASAP (24). More information is needed to better

characterize the circumstances under which this might occur and the probability of successful rehabilitation when there is recidivism.

In some incidents of more severe alcohol abuse problems, an enrolled Soldier may be admitted to an inpatient residential treatment facility (RTF) for more intensive treatment or detoxification. Such treatment must be authorized through the CCC and entails a six-week inpatient program at a RTF. Upon release, these Soldiers would be expected to undergo 365 days of outpatient alcohol treatment (24).

In many cases, Soldiers referred to the alcohol program for evaluation are not enrolled for treatment. If a Soldier is not enrolled, the evaluator must provide a reason explaining the decision to not enroll. Reasons for non-enrollment may include the following: referral to the ADAPT education and training program in lieu of more formal treatment (for example, if the counselor determines that the alcohol-related incident resulting in referral for evaluation is not indicative of a serious substance abuse problem, but rather a result of poor judgment or recreational use.); Commander decision to not enroll the Soldier; Soldier refuses treatment; and a counselor's determination that the Soldier does not, in fact, have a substance abuse problem.

The Army alcohol treatment program has evolved somewhat from its inception in 1971. Prior to 1988, ASAP (then ADAPCP) consisted of a system in which a Soldier could be enrolled in one of three tracks. Track 1, called "prevention training" prior to 1988, was identical to the current ADAPT program. If during Track 1, prevention training, a counselor determined that the Soldier needed additional intervention or treatment, he or she would be switched into Track 2 without any additional formal evaluation or enrollment processing. Track 2 mirrors the standard outpatient enrollment component of the current program. Soldiers whose condition necessitated inpatient treatment were enrolled in Track 3 from the start, similar to the current inpatient treatment program. Following the 6-week treatment at an RTF, a Soldier would then continue with Track 2 outpatient treatment. While the program has, in effect, not changed much over the past 30 years, record keeping and documentation of cases has. It is therefore difficult to track changes in characteristics of Soldiers referred to and enrolled in alcohol abuse programs between these two time periods. In addition, detailed information about the reasons for non-enrollment and the referral sources are only available after the transition away from the Track system beginning September 1988.

In 1994 Army Regulation 600-85 was amended by a directive to give the ASAP counselor ultimate authority to decide whether a Soldier is fit to return to duty, a responsibility formerly granted to Commanders. Despite this shift in formal regulations, however, Commanders still play a large role in a Soldier's treatment and often work with ASAP counselors to assess a Soldier's treatment performance and his or her ability to return to duty (24).

METHODS

THE DATA

Data for this study came from the Total Army Injury and Health Outcomes Database (TAIHOD)(2, 3), which uses encrypted individual identifiers to link records from a variety of U.S. Department of Defense administrative and health data sources. These include the Defense Manpower Data Center (DMDC), which contains personnel records such as age, rank, education level, and marital status; and the Drug and Alcohol Management Information System (DAMIS) database, which stores records from the ASAP.

DAMIS provides data on the occurrence of drug and alcohol problems identified through referrals for alcohol and drug treatment, and on follow-up/progress information for enrollees. Standard report forms DA4465 (evaluation) and DA4466 (progress reports) document the source of referrals (i.e., self, physician, or Commander-directed referrals), the reason for evaluation (alcohol, or a specific drug) enrollment decisions, and progress of a Soldier in treatment program. When a Soldier is not enrolled, a reason for non-enrollment is supplied. When a Soldier is released from the program, the reason for the release is supplied (e.g., completion of the program, return to duty, failure to comply with treatment, discharge from service). A Soldier may have multiple alcohol- or drug-related referrals and/or enrollments throughout his or her military career, each occurrence with related evaluation, enrollment decision and, where appropriate, follow-up and release data. Information about reasons for non-enrollment and source of referral is only available after September 1988, with the transition away from the track system. DAMIS data available in the TAIHOD extend through October 2003.

For this study, information related to a Soldier’s alcohol-related referral and corresponding evaluations, enrollments, and follow-up are used. All demographic information was extracted from the DMDC 6-month personnel file closest in time to the date of the initial alcohol referral for evaluation.

STUDY POPULATION

The study population comprised 188,139 Soldiers whose initial evaluation (first time in the system) for alcohol abuse occurred between September 1988 and October 2003. Where more than one alcohol-related referral and evaluation was conducted during the study period, only the first was included. A sub-study of factors associated with repeat enrollments uses Soldiers whose first-time alcohol evaluation took place between January 1, 1988 and December 31, 2000. The choice of December 2000 as the end date for inclusion in the sub-study was made in order to allow sufficient time to explore the risk for subsequent (repeat) ASAP encounters. Preliminary analyses for all evaluations from 1988 through 2000 suggested that the average length of time from first evaluation for an alcohol problem to a second ASAP evaluation for any problem was 673 days, or 1.84 years, and that by 900 days (2.5 years), 75% of Soldiers had been

evaluated a second time. Soldiers were followed through October 2003 to assess risk for subsequent repeat ASAP alcohol-related referral, allowing for at least 2.8 years of follow-up time.

ANALYSES

The demographic and occupational characteristics of Soldiers referred for evaluation were compared to the total U.S. Army population. Descriptive analyses included frequency distributions overall and by demographic subgroups in the Army. Analysis of associations between occupation and referral mechanism and treatment are stratified by enlisted and officer status, because many enlisted occupational specialties are not open to officers and, similarly, many officer occupational specialties are not open to enlisted personnel.

To explore any temporal effects on alcohol referrals or enrollment, we analyzed alcohol referral and evaluation rates over time. Chi-square analysis was used to identify significant differences in population characteristics. When comparisons were made, odds ratios (ORs) and accompanying 95% confidence intervals (CIs) are reported. When applicable, Chi-square tests for linear trends were conducted.

A sub-analysis of Soldiers evaluated for an alcohol problem but not enrolled for treatment was conducted. We analyzed the reason for non-enrollment by demographic characteristics and initial referral mechanism, and explored the circumstances under which a Commander or supervisor might decide against enrollment. Finally, we examined the factors associated with risk for a repeat alcohol-related enrollment, including the source of initial referral and treatment decision made during the first alcohol-related evaluation.

Analyses for this research were performed with SAS, Version 8 (42), and Epi Info (TM), Version 3.3.2 (16). All analyses for this project adhere to the policies for the protection of human subjects, as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

RESULTS

There were 188,139 Soldiers with one or more alcohol-related referral during the study period.

HOW DO SOLDIERS REFERRED TO ASAP FOR AN ALCOHOL EVALUATION DIFFER FROM THE ARMY POPULATION AT LARGE?

Table 1 displays the demographic characteristics of Soldiers in the study population at the time of their initial evaluation and the average demographic characteristics of the entire U.S. Army population over the study period. These unadjusted data suggest that Soldiers who are male, younger, lower-ranked, never

married, less well-educated, and have the occupation of infantry/gun crew or a tactical operations officers are overrepresented among alcohol-related referrals to ASAP.

It should be noted that missing demographic data, though rare, do not appear to be randomly distributed. Soldiers with missing data (particularly officers missing rank information) are at increased risk for ASAP alcohol referrals. It may be that Soldiers with serious alcohol-related problems or alcohol-related events are in the Army for a relatively short period of time, or are dismissed abruptly, and that less data are recorded in their files as a result.

Table 1. Demographic characteristics of the ASAP study population and comparison to the average general Army population, 1988-2003.

Demographics	ASAP Study Population N=188,139 Column%	Average General Army Population N=615,327 Column%
Gender		
Male	93.9	86.7
Female	6.1	13.2
Unknown	0.0	0.1
Age		
<21	25.9	14.5
21-25	45.8	32.1
26-30	15.4	20.7
31-35	7.5	14.9
36-40	3.8	10.7
>40	1.5	7.0
Unknown	0.1	0.2
Race/Ethnicity[a]		
White	65.6	62.0
African-American	23.9	27.1
Hispanic	5.5	5.4
Indian/Alaskan	1.3	0.6
Asian/Pacific	1.4	2.1
Other	2.2	2.5
Unknown	0.1	0.1
Marital Status		
Single	60.8	39.4
Married	35.0	54.3
Widowed/Divorced/Legally Separated	3.0	4.1
Unknown	1.2	2.3
Education		
< High School	2.6	1.4
High School Grad/GED/Alt. Education	91.3	75.9
Some College	2.0	5.0

Demographics	ASAP Study Population N=188,139 Column%	Average General Army Population N=615,327 Column%
>College degree	2.9	15.7
Unknown	1.3	2.1
Rank		
Enlisted Personnel	N=184,031[b]	N=523,080
E1-E4	79.5	56.9
E5-E6	16.9	31.7
E7-E9	3.6	11.9
Enlisted Unknown	0.0	0.0
Officers	N=4,108[b]	N=77,682
Warrant Officer	21.5	14.5
O1 – O3	61.2	0.3
O4 – O5	14.6	52.2
O6 – O11	2.5	28.0
Officer Unknown	0.3	5.0
Occupation Category		
Enlisted Personnel	N=184,031[b]	N=523,080
Infantry/Gun Crew	32.0	25.3
Electronic Equipment Repair	5.5	5.7
Communications/Intelligence	11.6	12.1
Health Care	6.4	7.8
Technical/Allied Special	2.5	3.1
Support/Administrative	10.9	16.2
Electrical/Mechanical Equipment Repair	16.5	14.9
Crafts Workers	2.6	2.1
Service/Supply	11.5	11.9
Non-occupational/Other[c]	0.4	0.6
Enlisted Unknown	0.1	0.2
Officers	N=4,108[b]	N=77,682
General Officer/ Executive	0.2	0.0
Tactical Operations	40.4	32.9
Intelligence Officer	4.7	5.4
Engineering & Maintenance Officer	13.2	11.0
Scientists & Professionals	2.4	5.8
Health Care Officer	12.9	16.3
Administrator	5.7	6.5
Supply, Procurement, Allied Officer	7.9	8.3
Non-occupational/Other[d]	12.1	12.9
Officer Unknown	0.5	0.4

[a]Data on race/ethnicity are missing from the 2003 DMDC personnel files (N=1,044). Percentages for the ASAP population were calculated out of 186,195 Soldiers, and average percentages for the general Army population were calculated over 15 years.

[b]Five Soldiers were of unknown rank and were not classifiable as either an officer or as enlisted personnel.
[c]Enlisted personnel listed as “non-occupational/other” include students, patients, prisoners, officers in training, and enlisted Soldiers in boot camp.
[d]Officers listed as “non-occupational/other” include patients, prisoners, advanced students, and other non-classifiable officer occupational categories.

We examined interactions between marital status and race, and marital status and gender for alcohol-related referrals. The majority of the Soldiers referred for an evaluation were single (60.8%). However, there were race-related differences in this association, such that black Soldiers referred for an evaluation were nearly twice as likely to be married than single as Soldiers of other ethnicities (OR = 1.82, 95% CI = 1.78 – 1.86). These differences could not be explained by overall differences in race and marital status in the Army population at large. In the general Army population, black Soldiers were slightly more likely than Soldiers of other races to be married (OR = 1.07, 95% CI = 1.06-1.07). Women referred to ASAP were significantly more likely to be no longer married (divorced, widowed, or separated) than men who were referred to ASAP (OR = 2.82, 95% CI = 2.61 – 3.04).

WHO WAS REFERRED TO ASAP FOR EVALUATION OF A POTENTIAL ALCOHOL PROBLEM, AND WHAT WAS THE REFERRAL MECHANISM?

Three sources account for over 70% of all referrals: Commander or supervisor recommendation (29.7%), legal investigation or apprehension (22.9%), and self-referral (18.8%) (Table 2).

Table 2. Sources of referral to ASAP for active-duty Army Soldiers with first-time alcohol evaluations, 1988-2003.

Source of Referral	Soldiers N=188,139 Column%
Commander/Supervisor	29.7
Investigation/Apprehension	22.9
Self	18.8
Medical/Physician-directed	12.6
Driving Under Influence[a]	11.6
Commander-directed Biochemical	3.5
Other Source [b]	0.5
Security Clearance	0.3
Family Member	0.1

[a]Referrals for Driving while Under Influence exist only after 1991.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Among referred Soldiers, all demographic variables (gender, age, ethnicity, marital status, education, rank, occupation) were significantly associated with referral source in unadjusted models ($p < 0.05$). There were some important and noteworthy

differences in reason for referral among male and female Soldiers. The most striking difference between the genders was the relative importance of investigation and apprehension as a source of referral for male Soldiers. Male Soldiers were more likely than female Soldiers to have been referred for evaluation as a result of an investigation (OR = 2.12, 95% CI = 2.01 – 2.25). They were also more likely to be referred as a result of apprehension for DUI of alcohol. By contrast, women were more likely than men to self-refer, to be referred by a medical care provider, or by a family member; OR for family referral for women versus men was 2.1 (95% CI = 1.36 – 3.21).

Table 3. Gender and source of referral to ASAP among active-duty Army Soldiers, 1988-2003.

Source of Referral	Gender[a]	
	Male N=176,630 Column %	Female N=11,426 Column%
Commander/Supervisor	29.5	32.7
Investigation/Apprehension	23.5	12.7
Self Referral	18.6	22.5
Medical/Physician-directed	12.1	20.6
Driving Under Influence	11.9	7.1
Commander-directed Biochemical	3.5	3.2
Other Source [b]	0.4	0.9
Security Clearance	0.3	0.3
Family Member	0.1	0.2

[a]There are 83 Soldiers of unknown gender.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Patterns of referral also vary with age. Increasing age is positively associated with a greater likelihood of self-referral (Chi Square for linear trend = 297, p<.005) and referral by family member or by medical staff. On the other hand, increasing age is negatively associated with Commander or supervisor referral (Chi-Square for linear trend = 2,337, p<.005). Odds of command referral versus other mechanism of referral among Soldiers under 21 were nearly twice that of Soldiers over 40 (OR = 2.42). Soldiers under the age of 21 were less likely than older Soldiers to be referred for evaluation as the result of a drinking-and-driving-related incident. Only 7.4% of Soldiers under the age of 21 were identified through a DUI compared to 11.6% or more of all other age groups (OR = 0.53, 95% CI = 0.51 – 0.55).

Table 4. Age and source of referral to ASAP for active-duty Army Soldiers, 1988-2003.

Source of Referral	Age[a]					
	Less than 21 N=48,778 Column%	21- 25 N=113,988 Column%	26-30 N=42,195 Column%	31-35 N=21,402 Column%	36-40 N=11,214 Column%	> 40 N=4,112 Column%
Commander/Supervisor	38.2	29.0	24.0	22.8	20.9	20.3
Investigation/Apprehension	21.7	22.8	25.0	24.5	21.9	19.1
Self	17.2	18.5	19.8	21.1	22.8	25.0
Medical/Physician-directed	10.9	12.5	13.4	14.3	16.7	19.4
Driving Under Influence	7.4	12.8	13.8	13.5	13.6	11.5
Commander-directed Biochemical	4.1	3.7	2.9	2.5	2.1	1.2
Other Source[b]	0.3	0.4	0.7	0.8	0.9	1.7
Security Clearance	0.3	0.3	0.3	0.2	0.4	0.4
Family Member	0.0	0.0	0.1	0.4	0.1	1.5

[a]222 Soldiers were of unknown age.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Race/ethnicity was associated with type of referral mechanism (Table 5). Whites were most likely to self-refer, while blacks were least likely. Black Soldiers were significantly more likely to be referred for evaluation as the result of a legal investigation (OR = 1.47, 95% CI = 1.43 – 1.51). Non-white Hispanics were more likely than other ethnic groups to be referred for evaluation following DUI investigation (OR = 1.52, 95% CI = 1.44 – 1.61). Soldiers of Native American ancestry were significantly more likely to be referred by Commanders than were Soldiers of other racial/ethnic backgrounds (OR = 1.29, 95% CI = 1.18 – 1.40).

Table 5. Race/ethnicity and source of referral to ASAP among active-duty Army Soldiers, 1988-2003.

	Race/ethnicity [a]					
Source of Referral	White N=122,123 Column%	Black N=44,499 Column%	Hispanic N=10,179 Column%	Indian/ Alaskan N=2,461 Column%	Asian/Pacific Islander N=2,662 Column%	Other N=4,165 Column%
Commander/Supervisor	30.7	26.9	28.7	35.2	32.5	28.0
Investigation/Apprehension	21.0	28.4	22.6	19.2	22.6	25.4
Self	21.0	13.6	16.3	21.7	15.1	16.5
Medical/Physician-directed	12.6	12.9	12.0	11.3	13.2	12.8
Driving Under Influence	10.5	13.3	16.2	9.4	12.5	13.4
Commander-directed Biochemical	3.3	4.1	3.6	2.5	3.4	2.9
Other Source [b]	0.4	0.6	0.4	0.4	0.3	0.7
Security Clearance	0.3	0.1	0.3	0.3	0.2	0.1
Family Member	0.1	0.1	0.1	0.1	0.2	0.1

[a]2,050 Soldiers were of unknown ethnicity.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Single Soldiers were significantly more likely to be referred for evaluation by a Commander or supervisor than were married or no-longer-married Soldiers. Married and no-longer-married Soldiers were more likely to self-refer. Those who were no longer married were significantly more likely than others to have been referred as the result of a DUI charge (OR = 1.33, 95% CI = 1.24 – 1.44) (Table 6).

Table 6. Marital Status and source of referral to ASAP among active-duty Army Soldiers, 1988-2003.

Source of Referral	Marital Status[a]		
	Single N=114,345 Column%	Married N=65,803 Column%	No Longer Married N=5,704 Column%
Commander/Supervisor	33.4	24.1	24.3
Investigation/Apprehension	21.9	24.7	23.8
Self	17.9	20.3	20.6
Medical/Physician-directed	10.7	15.8	13.0
Driving Under Influence	11.5	11.3	14.7
Commander-directed Biochemical	4.1	2.6	2.6
Other Source[b]	0.3	0.8	0.5
Security Clearance	0.3	0.2	0.3
Family Member	0.0	0.3	0.1

[a]2,287 Soldiers were of unknown marital status.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Of those Soldiers who were referred, those with no more than a high school education were more likely to be referred by a Commander or supervisor than Soldiers with higher levels of education (OR = 1.39, 95% CI = 1.32 – 1.46). They were also less likely than Soldiers with more than a high school degree to be referred by a family member, or as a result of DUI. Soldiers with at least a college degree were significantly more likely than Soldiers in any other educational category to have been referred as the result of DUI (OR = 1.63, 95% CI = 1.52 – 1.75).

Table 7. Education and source of referral to ASAP among active-duty Army Soldiers, 1988-2003.

Source of Referral	Education[a]			
	Less than High School N=4,861 Column%	High School/GED N=171,838 Column%	Some College N=3,717 Column%	College & Above N=5,364 Column%
Commander/Supervisor	35.8	29.8	23.7	23.5
Investigation/Apprehension	20.4	23.1	21.0	21.4
Self	19.5	18.7	21.7	21.5
Medical/Physician-directed	10.7	12.6	14.9	12.8
Driving Under Influence	7.8	11.5	13.9	17.4
Commander-directed	5.0	3.6	2.5	1.5

Source of Referral	Education[a]			
	Less than High School N=4,861 Column%	High School/GED N=171,838 Column%	Some College N=3,717 Column%	College & Above N=5,364 Column%
Biochemical				
Other Source[c]	0.4	0.4	1.2	1.0
Security Clearance	0.4	0.3	0.6	0.7
Family Member	0.0	0.1	0.5	0.4

[a]2,359 Soldiers had an unknown education level.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

There were slightly higher odds of Commander referrals for the lower-ranked enlisted Soldiers (E1-E4) (OR = 1.66, 95% CI = 1.62 – 1.70). Higher-ranking enlisted Soldiers (E7-E9) were 1.39 times more likely to self-refer than lower-ranked enlisted Soldiers.

Table 8. Rank and source of referral to ASAP among enlisted active-duty Army Soldiers, 1988-2003.

Source of Referral	Rank-Enlisted[a]		
	E1-E4 N=146,361 Column%	E5-E6 N=31,091 Column%	E7-E9 N=6,560 Column%
Commander/Supervisor N=54,973 (29.9%)	31.9	22.5	19.8
Investigation/Apprehension N=42,066 (22.9%)	21.9	27.1	23.5
Self N=34,545 (18.8%)	18.4	19.4	24.0
Medical/Physician-directed N=23,153 (12.6%)	12.1	14.0	15.9
Driving Under Influence N=21,181 (11.5%)	10.9	14.2	12.7
Commander-directed Biochemical N=6,562 (3.6%)	4.0	1.9	1.5
Other Source[b] N=818 (0.4%)	0.4	0.7	1.1
Security Clearance N=519 (0.3%)	0.3	0.2	0.3
Family Member N=195 (0.1%)	0.0	0.2	1.1

[a]19 enlisted Soldiers were of unknown rank.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

There were some variations in alcohol referral patterns across enlisted Soldier occupational specialties (Table 9). For example, Soldiers in healthcare occupations were somewhat more likely than other enlisted occupations to self-refer or be referred medically. They were also significantly less likely than others to be referred for evaluation as a result of an investigation (OR = 0.73, 95% CI = 0.69 – 0.77), while electrical and mechanical repairmen were slightly yet significantly more likely (OR = 1.13, 95% CI = 1.09 – 1.16).

Table 9. Occupation and source of referral to ASAP among enlisted active-duty Army Soldiers, 1988-2003.

Source of Referral	Occupation - Enlisted[a,b] Infantry/ Gun Crew N=58,795 Column%	Electronic Equip. Repair N=10,127 Column%	Communi-cation & Intelligence N=21,331 Column%	Health Care N=11,774 Column%	Technical Allied Special N=4,623 Column%	Support/ Admin. N=20,121 Column%	Electrical/ Mechanical repairs N=30,429 Column%	Craft-workers N=4,829 Column%	Service/ Supply N=21,216 Column%
Commander/ Supervisor N=54,676 (29.8%)	29.4	32.3	30.1	30.9	30.6	28.8	28.7	28.4	32.0
Investigation/ Apprehension N=41,963 (22.9%)	23.9	19.5	23.7	18.1	21.2	23.2	24.7	23.8	20.8
Self N=34,428 (18.8%)	18.3	18.3	19.2	20.1	20.9	17.9	18.8	20.5	19.4
Medical/Physician-directed N=23,055 (12.6%)	12.2	11.3	12.2	15.4	11.8	13.6	12.3	11.6	12.8
Driving Under Influence N=21,067 (11.5%)	11.4	12.5	10.5	11.8	11.6	12.3	11.8	11.8	10.8
Commander-directed Biochemical N=6,526 (3.6%)	4.2	3.7	3.2	3.1	3.4	3.2	3.0	3.4	3.5
Other Source[c] N=816 (0.5%)	0.3	0.5	0.4	0.5	0.4	0.7	0.5	0.4	0.5
Security Clearance N=519 (0.3%)	0.1	2.0	0.6	0.1	0.1	0.1	0.2	0.1	0.1
Family Member N=195 (0.1%)	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.1

[a]154 enlisted Soldiers were of unknown occupation.
[b]352 enlisted Soldiers were recorded in a Non-occupational other category which include students, patients, prisoners, officers in training and enlisted Soldiers in boot camp.
[c]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

In analyses unadjusted for age or education or other attributes, lower-ranking (O1-O3) officers were more likely to be referred by a Commander and through an investigation (Table 10). They were also significantly more likely to be referred subsequent to a DUI incident than higher-ranking commissioned officials (OR = 1.79, 95% CI – 1.38 – 2.32), while higher-ranked officers were significantly more likely to self-refer than O1-O3 officers (OR = 2.47, 95% CI = 2.04 – 2.99).

Table 10. Rank and source of referral to ASAP among active-duty Army officers, 1988-2003.

Source of Referral	Rank - Officers[a] Warrant Officer N=881 Column%	O1-O3 N=2,512 Column%	O4-O5 N=599 Column%	O6-O11 N=104 Column%
Commander/Supervisor N=951 (23.2%)	19.4	26.6	16.0	16.4
Investigation/Apprehension N=932 (22.8%)	24.1	24.5	15.4	11.5
Self N=862 (21.0%)	20.8	17.4	34.6	32.7
Driving Under Influence N=698 (17.4%)	16.1	18.9	12.2	7.7
Medical/Physician-directed N=523 (12.8%)	15.6	10.2	16.9	26.0
Other Source [b] N=130 (3.2%)	4.0	2.3	5.0	5.8

[a]12 Commanding Officers were of unknown rank.
[b]Other sources include Commander-Directed Biochemical, Family Member Referral, Security Clearance, Voluntary Test and all other, unspecified sources of referral.

Scientists and professionals were significantly more likely than others to self-refer (OR = 2.09, 95% CI = 1.34 – 3.25) (Table 11). Health care officers had lower odds of referral by investigation than other officers (OR = 0.48, 95% CI = 0.36 – 0.63).

Table 11. Occupation and source of referral to ASAP among active-duty Army officers, 1988-2003.

Source of Referral	Occupation - Officers[a,b]							
	General Officer/ Executive N=6 Column%	Tactical Operations Officer N=1,659 Column%	Intelligence Officer N=193 Column%	Engineering & Maintenance N=544 Column%	Scientists & Professionals N=97 Column%	Health Care N=530 Column%	Administrators N=236 Column%	Supplies, Procurement, Allied N=324 Column%
Commander/ Supervisor N=808 (22.5%)	16.7	23.6	18.7	23.0	19.6	21.1	24.2	20.4
Investigation/ Apprehension N=796 (22.2%)	0.0	25.6	22.8	23.0	14.4	13.0	20.3	22.2
Self N=778 (21.7%)	16.7	18.5	22.3	21.9	36.1	26.2	22.5	25.0
Driving Under Influence N=632 (17.6%)	0.0	18.4	21.2	15.6	9.3	18.1	16.1	17.6
Medical/Physician- directed N=457 (12.7%)	66.7	11.1	7.8	12.9	15.5	19.1	13.1	11.4
Other Source[c] N=(118 3.3%)	0.0	2.8	7.3	3.7	5.2	2.5	3.8	3.4

[a]20 Officers Soldiers were of unknown occupation.
[b]498 officers were listed as “non-occupational,” which include patients, prisoners, advanced students, and other non-classifiable officer occupational categories.
[c]Other sources include Commander-Directed Biochemical, Family Member Referral, Security Clearance, Voluntary Test and all other unspecified sources of referral.

WHO WAS ENROLLED IN THE ARMY'S TREATMENT PROGRAM FOLLOWING AN EVALUATION FOR ALCOHOL PROBLEMS?

Of the 188,139 individuals referred for initial evaluation, just over half (57%) were ultimately enrolled in the ASAP treatment program, though some additional Soldiers were ultimately referred to the Army's ADAPT education training course (see section V below for more details on those not enrolled). Factors associated with increased likelihood of enrollment subsequent to evaluation include male gender, older age (>35), Indian/Alaskan Native and white racial/ethnic groups, single marital status, lesser educational attainment, and enlisted rank. Indian and Alaskan Soldiers had the highest proportion of enrollees of any racial/ethnic group and were significantly more likely to be enrolled than Soldiers in all other racial/ethnic groups combined (OR = 1.44, 95% CI = 1.33-1.57), followed by whites (OR=1.21, 95% CI = 1.19 – 1.23), while Blacks were significantly less likely to be enrolled (OR = 0.80, 95% CI = 0.79 – 0.82). Though single Soldiers evaluated for an alcohol problem were significantly more likely to be enrolled, the effect size was quite small (OR=1.04, 95% CI = 1.02 – 1.06). There was a strong inverse relationship with education and likelihood of enrollment, with less-educated Soldiers more likely to enroll than Soldiers with at least college degrees (OR = 1.45, 95% CI = 1.37 – 1.53). Enrollment was more common among enlisted Soldiers than warrant and commissioned officers (58% of enlisted compared to 45% of warrant and commissioned officers). Lower-ranked enlisted Soldiers were *more* likely to enroll, while warrant officers and lower-ranked commissioned officers were *less* likely to enroll. Officers ranked O4-O5 had the greatest likelihood of enrollment when all other ranks were collapsed (OR = 2.25, 95% CI = 2.12 – 3.07), while lower-ranked O1-O3 officers had significantly lower odds of enrollment.

We evaluated the odds of enrollment for each occupational category compared to the collapsed category of "all other occupations" in separate models for enlisted Soldiers and officers. Among enlisted occupations, Soldiers in support and/or administration occupations were significantly less likely to be enrolled than nearly all other occupational specialties. Enlisted Soldiers in the communications/intelligence, electronic equipment repair, and administrative/support fields all had slightly but significantly lower odds of enrollment, while electrical and mechanical repair workers had slight yet significant greater odds of enrollment compared to other enlisted Soldiers (OR = 1.05, 95% CI = 1.03 – 1.08). Enlisted Soldiers with an occupational category of "non-occupational, other" were at substantially lower odds of enrollment (OR = 0.66, 95% CI = 0.56 – 0.77). These non-occupational enlisted Soldiers consist of students, prisoners, patients, officers in training, and Soldiers in boot camp. Among the officers, scientists and professionals and health care officers were significantly more likely to be enrolled when compared to all other occupational categories. Tactical operations and non-occupational officers were significantly less likely to be enrolled (OR = 0.73, 95% CI = 0.64 – 0.82 and OR = 0.76, 95% CI = 0.62 – 0.92, respectively) when compared to all other categories (Table 12).

Table 12. Demographics of active-duty Army Soldiers who were evaluated, comparing those who enrolled in ASAP with those who did not, 1988-2003.

Demographics	Enrolled in ASAP N=107,792 (57.3%) Row% Column%	Not Enrolled N=80,347 (42.7%) Row% Column%	Odds Ratio[a]	95% Confidence Interval
Gender (83 of unknown gender)				
Male N=176,630	57.5 94.2	42.5 93.3	1.12	1.07 – 1.16
Female N=11,426	54.8 5.8	45.2 6.4	1.00	NA
Age (222 of unknown age)				
<21 N=48,778	56.9 25.7	43.2 26.2	1.00	NA
21-25 N=86,223	57.8 46.2	42.2 45.3	1.04	1.01 – 1.06
26-30 N=28,886	56.5 5.1	43.5 15.7	0.98	0.96 – 1.01
31-35 N=14,070	56.9 7.4	43.1 7.6	1.00	0.96 – 1.04
36-40 N=7,167	58.2 3.9	41.8 3.7	1.06	1.01 – 1.11
>40 N=2,793	58.9 1.5	41.2 1.4	1.09	1.01 – 1.18
Race/Ethnicity (2,050 of unknown race)				
White N=122,123	59.0 67.4	41.0 63.1	1.26	1.23 – 1.29
African-American N=44,499	53.3 22.2	46.7 26.2	1.00	N/A
Hispanic N=10,179	54.9 5.2	45.1 5.8	1.07	1.02 – 1.11
Indian/Alaskan N=2,461	66.0 / 1.5	34.1 1.1	1.70	1.56 – 1.85
Asian/ Pacific Islander N=2,662	53.5 1.3	46.5 1.6	1.01	0.93 – 1.09
Other N=4,165	57.7 2.3	42.3 2.2	1.19	1.12 – 1.27
Marital Status (2,287 of unknown marital status)				
Single N=114,345	57.7 61.2	42.3 60.3	1.05	1.03 – 1.07
Married N=65,803	56.5 34.5	43.5 35.6	1.00	N/A
Widowed/Divorced/Legally	58.0	42.0	1.06	1.00 – 1.12

Demographics	Enrolled in ASAP N=107,792 (57.3%) Row% Column%	Not Enrolled N=80,347 (42.7%) Row% Column%	Odds Ratio[a]	95% Confidence Interval
Separated N=5,704	3.1	3.0		
Education (2,359 of unknown education)				
< High School N=4,861	58.0 2.6	42.0 2.5	1.47	1.36 – 1.59
High School Grad/GED/ Alt. Ed. N=171,838	57.7 92.0	42.3 90.5	1.45	1.37 – 1.53
Some College N=3,717	55.3 1.9	44.7 2.1	1.32	1.21 – 1.43
>College degree N=5,364	48.5 2.4	51.5 3.4	1.00	N/A
Rank				
Enlisted Personnel N=184,031 (19 of unknown rank)	*N=105,958 (57.6%)*	*N=78,073 (42.4%)*		
E1-E4 N=146,361	58.3 80.6	41.7 78.2	1.07	1.01 – 1.12
E5-E6 N=31,091	54.3 15.9	45.7 18.2	0.91	0.86 – 0.96
E7-E9 N=6,560	56.7 3.5	43.3 3.6	1.00	N/A
Officers N=4108 (12 of unknown rank)	*N= 1,834 (44.6%)*	*N = 2,274 (55.4%)*		
Warrant Officer N=881	45.2 21.7	54.8 21.2	0.52	0.33 – 0.80
O1 – O3 N=2,512	38.9 53.3	61.1 67.5	0.40	0.26 – 0.61
O4 – O5 N=599	64.1 20.9	35.9 9.5	1.12	0.71 – 1.75
O6 – O11 N=104	61.5 3.5	38.5 1.7	1.00	N/A
Occupation category				
Enlisted personnel N=184,031 (126 of unknown occupation)	*N=105,958 (57.6%)*	*N=78,073 (42.4%)*		
Infantry/Gun Crew N=58,795	57.9 32.1	42.1 31.7	1.05	1.02 – 1.09
Electronic Equipment Repair N=10,127	55.4 5.3	44.6 5.8	0.95	0.91 – 1.00
Communications/ Intelligence N=21,331	55.6 11.2	44.4 12.1	0.92	1.00
Health Care	58.0	42.0	1.06	1.01 – 1.11

Demographics	Enrolled in ASAP N=107,792 (57.3%) Row% Column%	Not Enrolled N=80,347 (42.7%) Row% Column%	Odds Ratio[a]	95% Confidence Interval
N=11,774	6.4	6.3		
Technical/Allied Special N=4,623	57.5 2.5	42.6 2.5	1.04	0.97 – 1.11
Support/Admin. N=20,121	56.6 10.7	43.4 11.2	1.00	N/A
Electrical/Mechanical equip. repair N=30,429	58.6 16.8	41.4 16.1	1.09	1.05 – 1.13
Crafts workers N=4,829	61.4 2.8	38.6 2.4	1.22	1.14 – 1.30
Service/Supply N=21,216	58.6 11.7	41.4 11.3	1.09	1.04 – 1.13
Non-occupational/ Other[b] N=660	47.1 0.3	52.9 0.5	0.68	0.58 – 0.80
Officers N=4,108 (20 officers of unknown occupation)	*N= 1,834 (44.6%)*	*N = 2,274 (55.4%)*		
General Officer/ Executive N=6	16.7 0.1	83.3 0.2	--	--
Tactical Operations N=1,659	39.8 36.0	60.2 43.9	0.51	0.42 – 0.63
Intelligence Officer N=193	39.9 4.2	60.1 5.1	0.52	0.36 – 0.73
Engineering & Maintenance N=544	46.1 13.7	53.9 12.9	0.67	0.52 – 0.85
Scientists & Professionals N=97	61.9 3.3	38.1 1.6	1.26	0.79 – 2.02
Health Care Officer N=530	56.2 16.3	43.8 10.2	1.00	N/A
Administrator N=236	50.0 6.4	50.0 5.2	0.78	0.57 – 1.07
Supply, Procurement, Allied N=325	49.5 8.8	50.5 7.2	0.76	0.57 – 1.02
Non-occupational/ Other[c] N=498	38.6 10.5	61.5 13.5	0.49	0.38 – 0.63

[a]Odds ratios are unadjusted.
[b]Enlisted personnel listed as “non-occupational/other” include students, patients, prisoners, officers in training, and enlisted Soldiers in boot camp.
[c]Officers listed as “non-occupational/other” include patients, prisoners, advanced students, and other non-classifiable officer occupational categories.

WHO WAS REFERRED FOR AN ALCOHOL EVALUATION BUT NOT ENROLLED IN THE ARMY'S TREATMENT PROGRAM, AND WHY?

About 43% of the 188,139 Soldiers initially referred to ASAP for an alcohol evaluation were never enrolled in a treatment program. Though not officially "enrolled" in one of the Army's tracks for treating alcohol-related disorders, approximately two-thirds of these non-enrolled Soldiers (N = 53,581) were referred to ADAPT, a mandatory short alcohol education and prevention short course.

Of those evaluated but not enrolled, 19% were not enrolled because the counselor determined that the Soldier did not have a substance abuse problem and 9% were not enrolled because their Commander recommended against enrollment. Nearly 4% were referred to resources for problems other than substance abuse, such as family counseling or mental health services. Approximately 2% of Soldiers were not enrolled because they refused services. Less than 1% of Soldiers (N=46) were not enrolled because their urinalysis results were determined to be due to legally prescribed medication.

Reasons for non-enrollment were associated with the demographic characteristics of the Soldier under evaluation. Of non-enrolled males, 67% were sent to ADAPT prevention training compared to 60% of non-enrolled females. Female Soldiers referred for alcohol evaluation were more likely than male Soldiers to be found free of an alcohol problem (OR = 1.26, 95% CI = 1.17 – 1.35), and were over two and a half times more likely than males to be referred for services other than alcohol treatment (OR = 2.57, 95% CI = 2.30 – 2.86) (Table 13).

Table 13. Gender and reason for non-enrollment in ASAP among active-duty Army Soldiers referred to ASAP, 1988-2003.

Reason for Non-enrollment	Gender[a]	
	Male N=75,147 Column%	Female N=5,169 Column%
Refer to ADAPT	67.2	59.8
No Alcohol/Drug Problem	18.5	22.2
Commander Decided not to Enroll Patient	9.4	8.1
Refer to Other than Alcohol/Drug Resources	3.3	8.0
Patient Refused Services	1.7	1.8
Prescribed Medication	0.1	0.2

[a]31 non-enrolled Soldiers were of unknown gender.

Among those not enrolled, there was a strong and significant increasing likelihood of referral to the ADAPT program with decreasing age (Chi Square for linear trend =1224, p<.005). Soldiers under age 21 were over three times more likely than Soldiers over 40 to receive this alternative training. There was also a significantly increased likelihood with age that Soldiers were not enrolled because the counselor determined that the Soldier did not have an alcohol problem: Soldiers over age 40 who were not enrolled were more than twice as likely to be found free of a substance abuse problem as those under age 21 who were not enrolled (Chi-Square for linear trend = 642, p<.005). Older Soldiers were more likely than younger ones to be referred for services other than for substance abuse (Chi Square for trend = 788, p<.005).

Table 14. Age and reason for non-enrollment in ASAP among active-duty Army Soldiers, 1988-2003.

Reason for Non-enrollment	Age[a]					
	< 21 N=21,049 Column%	21-25 N=36,421 Column%	26-30 N=12,277 Column%	31-35 N=6,066 Column%	36-40 N=2,994 Column%	> 40 N=1,147 Column%
Refer to ADAPT	72.6	67.9	63.1	58.5	51.7	41.3
No Alcohol/Drug Problem	15.3	17.5	21.9	24.0	27.5	30.7
Commander Decided not to Enroll Patient	8.6	10.0	8.8	9.0	9.1	10.3
Refer to Other than Alcohol/ Drug Resources	2.2	2.8	4.5	6.5	8.8	12.6
Patient Refused Services	1.3	1.7	1.7	1.9	2.9	5.0
Prescribed Medication	0.1	0.1	0.0	0.1	0.1	0.2

[a]93 non-enrolled Soldiers were of unknown age.

Black Soldiers referred to ASAP but not enrolled were more likely than Soldiers in other racial/ethnic groups to be found free of any alcohol problem after evaluation (OR = 1.15, 95% CI = 1.11 – 1.20) (Table 14).

Table 15. Race/Ethnicity and reason for non-enrollment in ASAP among active-duty Army Soldiers, 1988-2003.

Reason for Non-enrollment	Race/Ethnicity[a] White N=50,083 Column%	Black N=20,780 Column%	Hispanic N=4,594 Column%	Indian/ Alaskan N=838 Column%	Asian/Pacific Islander N=1,239 Column%	Other N=1,763 Column%
Refer to ADAPT	66.5	65.3	71.1	69.1	70.8	68.1
No Alcohol/Drug Problem	18.5	20.4	15.6	16.8	16.3	18.9
Commander Decided not to Enroll Patient	9.5	9.1	8.6	8.6	7.5	9.1
Refer to Other than Alcohol/Drug Resources	3.7	3.6	2.8	2.9	3.6	2.9
Patient Refused Services	1.7	1.6	1.8	2.5	1.8	1.0
Prescribed Medication	0.1	0.0	0.1	0.1	0.0	0.0

[a]1,050 non-enrolled Soldiers were of unknown ethnicity.

Reason for non-enrollment also covaried with marital status: single Soldiers were more likely than married Soldiers and no-longer-married Soldiers to be referred to prevention training (ADAPT). They were also less likely than other groups to be found free of an alcohol problem, or to be referred to services to treat problems other than those related to substance abuse.

Table 16. Marital Status and reason for non-enrollment in ASAP among active-duty Army Soldiers, 1988-2003.

Reason for non-enrollment	Marital status[a] Single N=48,418 Column%	Married N=28,614 Column%	No Longer Married N=2,398 Column%
Refer to ADAPT	70.9	60.3	61.3
No Alcohol/Drug Problem	16.0	22.9	22.2
Commander Decided not to Enroll Patient	9.3	9.3	9.1
Refer to Other than Alcohol/Drug Resources	2.3	5.5	5.5
Patient Refused Services	1.6	1.9	1.8
Prescribed Medication	0.1	0.1	0.1

[a]917 non-enrolled Soldiers were of unknown marital status.

Higher education was associated with an increased likelihood of non-enrollment, because the counselor found no evidence of an alcohol problem: Soldiers with at least some college education had a 48% greater chance than Soldiers with a high school degree or less of not being enrolled for this reason (OR = 1.48, 95% CI = 1.38 – 1.59). Soldiers with no-greater-than a high school education were also 1.52 times more likely than Soldiers with greater education to be referred to ADAPT prevention training than non-enrolled Soldiers with at least some college education (OR = 1.49, 95% CI = 1.40 – 1.59) (Table 17).

Table 17. Education and reason for non-enrollment in ASAP among active-duty Army Soldiers, 1988-2003.

Reason for Non-enrollment	Education[a] Less than High School N=2,042 Column%	High School/ GED N=72,684 Column%	Some College N=1,660 Column%	College & Above N=2,764 Column%
Refer to ADAPT	67.9	67.3	57.3	58.4
No Alcohol/Drug Problem	17.4	18.4	25.0	25.0
Commander Decided not to Enroll Patient	10.0	9.3	9.6	7.3
Refer to Other than Alcohol/Drug Resources	2.8	3.4	6.1	7.2
Patient Refused Services	1.7	1.6	1.9	2.1
Prescribed Medication	0.2	0.1	0.1	0.1

[a]1,197 non-enrolled Soldiers had an unknown education level.

Higher-ranking enlisted Soldiers (E7+) were more likely than Soldiers of lower rank (E1-E4) to not be enrolled because they were found to have no alcohol problem (OR = 1.91, 95% CI = 1.76 – 2.08). Often they were found to have problems other than those related to alcohol. Non-enrolled E7-E9 Soldiers were over 3 times more likely than non-enrolled enlisted Soldiers of lower ranks to be referred to services other than alcohol or drug services.

Few significant differences in reasons for non-enrollment were found amongst different occupations. Infantry Soldiers had slightly but significantly higher odds than all other non-enrolled enlisted Soldiers of not being enrolled because of Commander intervention (OR = 1.20, 95% CI = 1.14 – 1.27). Health care workers were significantly more likely to be referred to services for reasons other than substance abuse (OR = 1.75, 95% CI = 1.54 – 1.99).

Table 18. Rank and reason for non-enrollment in ASAP among enlisted active-duty Army Soldiers, 1988-2003.

Reason for Non-enrollment	Rank – Enlisted[a]		
	E1-E4 N=61,016 Column%	E5-E6 N=14,208 Column%	E7-E9 N=2,839 Column%
Refer to ADAPT N=52,312 (67.0%)	69.2	61.3	49.4
No Alcohol/Drug Problem N=14,391 (18.4%)	16.7	23.7	29.6
Commander Decided not to Enroll Patient N=7,344 (9.4%)	9.8	7.9	8.6
Refer to Other than Alcohol/Drug Resources N=2,668 (3.4%)	2.7	5.5	9.6
Patient Refused Services N=1,305 (1.7%)	1.6	1.6	2.8
Prescribed Medication N=43 (0.1%)	0.1	0.1	0.0

[a]10 non-enrolled enlisted Soldiers were of an unknown rank.

Table 19. Occupation and reason for non-enrollment in ASAP among enlisted active-duty Army Soldiers, 1988-2003.

Reason for Non-enrollment	Occupation-enlisted [a,b]								
	Infantry/ Gun Crew N=24,769 Column%	Electronic Equipment Repair N=4,517 Column%	Communication & Intelligence N=9,478 Column%	Health Care N=4,946 Column%	Technical Allied Special N=1,967 Column%	Support/ Admin. N=8,740 Column%	Electrical Mechanical Equip. Repairs N=12,592 Column%	Craft workers N=1,866 Column%	Service/ Supply N=8,786 Column%
Refer to ADAPT N=52,014 (67.0%)	68.1	69.3	67.3	62.8	65.8	64.6	68.0	67.6	65.8
No Alcohol/Drug Problem N=14,347 (18.5%)	17.1	16.1	19.5	20.4	20.6	20.3	18.5	17.2	19.4
Commander Decided not to Enroll Patient N=7,310 (9.4%)	10.5	9.1	8.7	9.7	8.2	8.5	9.0	10.6	8.6
Refer to Other than Alcohol/ Drug Resources N=2,652 (3.4%)	2.5	3.8	3.1	5.6	3.7	4.8	3.0	2.7	4.3
Patient Refused Services N=1,295 (1.7%)	1.8	1.7	1.5	1.6	1.6	1.7	1.4	1.8	1.9
Prescribed Medication N=43 (0.1%)	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1

[a] 63 non-enrolled enlisted Soldiers had an unknown occupation.
[b] 349 non-enrolled Soldiers were classified as Non-occupational others. This group includes a variety of titles such as students, patients, prisoners, officers in training and enlisted Soldiers in boot camp.

Most officers not enrolled in ASAP were either enrolled in an alternate prevention program (56%), or were found not to have an alcohol problem (27%). Higher-ranking officers (O6 – O11) were over 10 times as likely as other officers to be referred to resources other than alcohol or drugs (OR = 10.76, 95% CI = 5.36 – 21.51). Tactical operations officers were the occupational group most likely to be sent to ADAPT instead of enrollment compared to all other officers (OR = 1.68, 95% CI = 1.40 – 2.02).

Table 20. Rank and reason for non-enrollment in ASAP among active-duty Army officers, 1988-2003.

Reason for Non-enrollment	Rank - officers [a]			
	Warrant Officer N=483 Column%	O1-O3 N=1,534 Column%	O4-O5 N=215 Column%	O6-O11 N=40 Column%
Refer to ADAPT N=1,262 (55.5%)	52.8	59.8	38.6	15.0
No Alcohol/Drug Problem N=622 (27.4%)	30.6	26.6	26.5	22.5
Refer to Other than Alcohol/Drug Resources N=191 (8.4%)	5.8	7.0	17.7	42.5
Commander Decided not to Enroll Patient N=151 (6.6%)	8.9	5.4	9.3	12.5
Patient Refused Services N=43 (1.9%)	1.9	1.0	7.4	7.5
Prescribed Medication N=3 (0.1%)	0.0	0.1	0.5	0.0

[a] 2 non-enrolled Officers were of an unknown rank.

Table 21. Occupation and reason for non-enrollment in ASAP among active-duty Army officers, 1988-2003.

Reason for Non-enrollment	Occupation – Officers [a,b] General Officer/ Executive N=5 Column%	Tactical Operations Officer N=999 Column%	Intelligence Officer N=116 Column%	Engineering & Maintenance N=293 Column%	Scientists & Professionals N=37 Column%	Health Care N=232 Column%	Admini-strators N=118 Column%	Supplies, Procurement Allied N=164 Column%
Refer to ADAPT N=1,120 (57.0%)	0.0	63.3	55.2	55.6	40.5	42.7	54.2	50.6
No Alcohol/Drug Problem N=505 (25.7%)	0.0	23.8	26.7	29.4	32.4	30.6	22.0	25.0
Commander Decided not to Enroll Patient N=137 (7.0%)	0.0	7.1	4.3	6.8	10.8	8.2	5.1	7.3
Refer to Other than Alcohol/Drug Resources N=159 (8.1%)	100.0	5.1	11.2	6.8	8.1	12.9	14.4	12.2
Patient Refused Services N=40 (2.0%)	0.0	0.6	2.6	1.4	8.1	5.2	4.2	4.3
Prescribed Medication N=3 (0.2%)	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.6

[a]4 non-enrolled officers had an unknown occupation.
[b]306 non-enrolled officers were classified as "non-occupational," which include patients, prisoners, advanced students, and other non-classifiable officer occupational categories.

IS REFERRAL MECHANISM ASSOCIATED WITH WHETHER OR NOT A SOLDIER WHO IS EVALUATED FOR AN ALCOHOL PROBLEM ULTIMATELY GETS ENROLLED FOR TREATMENT?

Is referral mechanism associated with enrollment?

Self-referred Soldiers were almost three times more likely to enroll than Soldiers referred by other means (OR = 2.79, 95% CI = 2.72 – 2.87). Surprisingly, only 51% of those referred through the medical system were ultimately enrolled in ASAP (OR = 0.73, 95% CI = 0.71 – 0.75), and Soldiers initially referred by a Commander were also less likely to enroll (OR = 0.86, 95% CI = 0.85 – 0.88). Soldiers referred by a family member were not likely to be enrolled in the ASAP program (OR = 0.63, 95% CI = 0.48 – 0.82), and neither were Soldiers referred to ASAP after an investigation or legal apprehension (OR = 0.65, 95% CI = 0.64 – 0.66). Soldiers evaluated for security clearances were significantly less likely to be enrolled than Soldiers referred by other sources (OR = 0.16, 95% CI = 0.13 – 0.20).

Table 22. Source of referral to ASAP and enrollment decision of active-duty Army Soldiers, 1988-2003.

Source of Referral	Enrollment Decision	
	Enrolled N=107,792 Column%	Not Enrolled N=80,347 Column%
Commander/Supervisor	28.5	31.5
Investigation/Apprehension	19.6	27.2
Self	24.9	10.6
Medical/Physician-directed	11.1	14.6
Driving while Under Influence	11.4	12.0
Commander-directed Biochemical	4.0	2.8
Other Source[a]	0.3	0.6
Security Clearance	0.1	0.6
Family Member	0.1	0.2

[a]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Is the initial referral source associated with the reason they were not enrolled?

Medical referral for alcohol evaluations that do not result in enrollment in the Army's alcohol treatment program. Of the 11,708 non-enrolled Soldiers initially referred for alcohol evaluation by a medical doctor, most (47%) were referred to ADAPT for prevention training. Surprisingly, many Soldiers referred for alcohol evaluation by a medical care provider were not enrolled because the alcohol counselor determined that the Soldier did not have a substance abuse problem after all. This type of non-enrollment occurred more commonly in this group than among non-enrolled Soldiers

referred by other mechanisms (OR = 2.07, 95% CI = 1.98 – 2.17). Medically-referred Soldiers not enrolled were also more 50% more likely than their non-enrolled peers referred via other mechanisms to have their Commander intervene and not recommend treatment (OR = 1.54, 95% CI =1.45 – 1.63).

Referrals for alcohol evaluation after DUI that do not result in enrollment in the Army's alcohol treatment program. The vast majority of those originally referred after a DUI but not enrolled in ASAP were instead placed in an alternative drug and alcohol prevention program (86%, N = 8,250).

Family member referral for alcohol evaluations that do not result in enrollment in the Army's alcohol treatment program. Family member referrals often appear to occur when there are a range of problems and may not be alcohol-related. Non-enrolled Soldiers referred by family members were nearly 10 times as likely to be referred to services other than alcohol and/or drug treatment than non-enrolled Soldiers referred by other means (OR = 9.75, 95% CI = 6.32 – 14.96).

Referrals for alcohol evaluations after investigation that do not result in enrollment in the Army's alcohol treatment program. Soldiers initially referred after an investigation were significantly less likely than Soldiers with other sources of referral to be denied enrollment by a Commander (OR = 0.69, 95% CI = 0.65 – 0.73).

Table 23. Source of referral to ASAP and reason for non-enrollment of active-duty Army Soldiers, 1988-2003.

Source of Referral	Reason for non-enrollment: Refer to ADAPT N=53,581 Row% Column%	No Alcohol or Drug Problem N=15,014 Row% Column%	Commander Decided to not Enroll N=7,495 Row% Column%	Refer to Other Resources N=2,861 Row% Column%	Patient Refused Services N=1,350 Row% Column%	Prescribed Medication N=46 Row% Column%
Commander/Supervisor N=25,268	68.1 32.1	19.6 32.9	8.6 29.0	2.8 24.7	0.9 17.6	0.0 19.6
Investigation/Apprehension N=21,873	72.7 29.7	18.3 26.7	7.2 21.0	1.3 10.0	0.5 7.5	0.0 6.5
Medical/Physician-directed N=11,708	47.0 10.3	29.6 23.1	12.8 20.0	7.4 30.1	3.2 27.7	0.1 17.4
Driving while Under Influence N=9,615	85.8 15.4	2.7 1.8	8.7 11.1	1.1 3.7	1.6 11.6	0.1 17.4
Self N=8,541	56.9 9.1	19.2 10.9	10.5 12.0	8.9 26.6	4.4 27.9	0.1 10.9
Commander-directed Biochemical N=2,274	64.7 2.8	12.1 1.8	18.0 5.5	2.1 1.6	2.6 4.4	0.5 23.9
Other Source[a] N=500	44.4 0.4	29.2 1.0	13.2 0.9	7.4 1.3	5.6 2.1	0.2 2.2
Security Clearance N=450	31.1 0.3	54.9 1.7	7.6 0.5	5.8 0.9	0.7 0.2	0.0 0.0
Family Member N=118	29.7 0.1	25.4 0.2	6.8 0.1	26.3 1.1	11.0 1.0	0.9 2.2

[a]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

While Commander referral to ASAP was the most common referral source, accounting for nearly a third of the evaluated population, Commander recommendation not to enroll a Soldier was the third most common reason for non-enrollment. In fact, 29% percent of Soldiers not enrolled because of a command decision were initially referred for an evaluation by a Commander or supervisor, though Commander-referred Soldiers are less likely than other referred Soldiers to experience Commander intercession (OR = 0.88, 95% CI = 0.84 – 0.93).

We analyzed the subgroup of Soldiers originally referred by a Commander for evaluation but then not enrolled because of Command intercession and compared them to Commander-referred Soldiers enrolled in ASAP. While our results did not yield many statistically significant associations, certain findings are worth noting (data not shown). Black Soldiers were more likely to not be enrolled because of Commander intercession than all other races (OR = 1.15, 95% CI = 1.03 – 1.28). Commander-referred Soldiers with a high school degree, or degree equivalent, were 24% less likely to not enroll because of Commander intercession compared to Soldiers with other education levels (OR = 0.76, 95% CI = 0.65 – 0.88). Enlisted Soldiers in health care who were Commander-referred were significantly more likely than our referent group of enlisted support and administrative staff to not enroll because of Commander decision, and this difference remained when we collapsed all other occupational categories (OR = 1.24, 95% CI = 1.05 – 1.46).

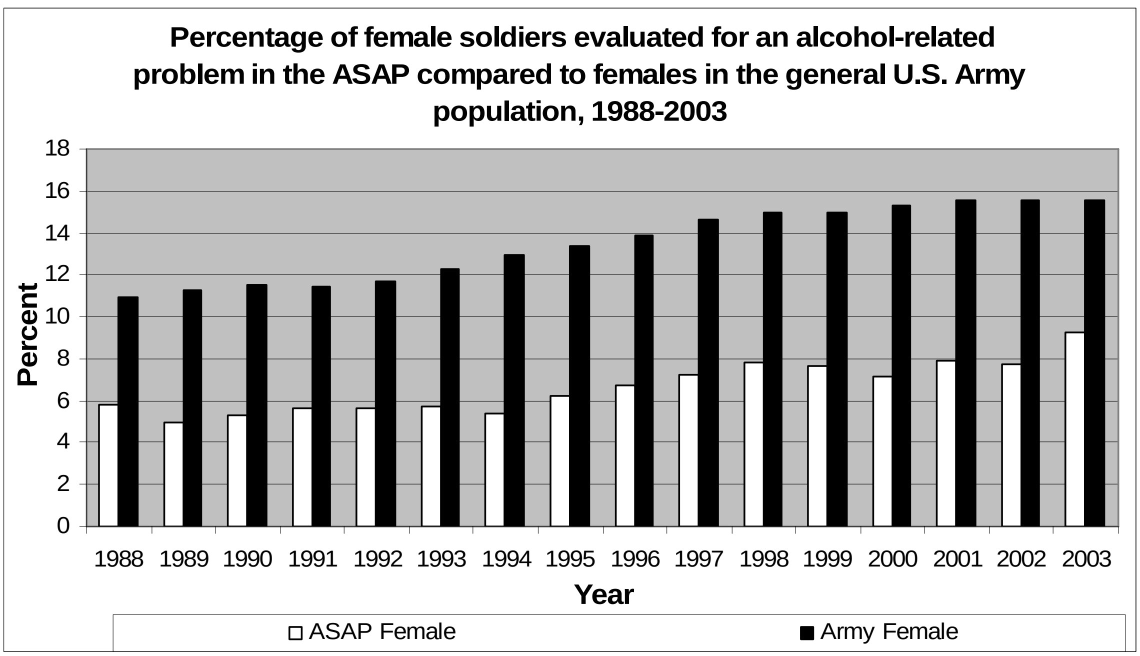
We also analyzed the subgroup of Soldiers originally referred by medical personnel and compared those not enrolled because a Commander or supervisor intervened to those enrolled in ASAP. We found a few statistically significant differences by demographic characteristics (data not shown). For example, such interventions were more likely to happen with blacks than other ethnicities (OR = 1.16, 95% CI = 1.02 – 1.32), and were significantly less likely to occur with Soldiers of Indian/Alaskan descent compared to all other ethnicities (OR = 0.52, 95% CI = 0.27 – 0.99). Those in infantry compared to all other enlisted occupations (OR = 1.24, 95% CI = 1.10 – 1.39) were more likely to have a Commander decide not to enroll them in ASAP treatment among the medically-referred.

WHO GETS A SECOND CHANCE: REPEAT REFERRALS FOR ALCOHOL EVALUATION?

There was a slightly lower rate of repeat referrals in the follow-up period for those whose first alcohol evaluation was recorded between 1998 and 2003, (15%) compared with those whose initial alcohol evaluation was in 1988-1992 (23%) or 1993-1997 (21%). Variations might be explained by actual changes in recidivism, changes in overall rates of problems due to changes in the demographic composition of the Army population over time, changes in detection of alcohol-related problems, changes in likelihood of referral given identification of a problem, or by the fact that there is less opportunity to have a repeat event in the second period because of shorter follow-up time. It is not possible with these data to test all of these hypotheses. However, additional analyses were conducted in order to assess the effects of changes in the

gender composition of the Army. There have been important shifts over time in the demographic composition of the Army with the proportion of female enlisted Soldiers rising approximately 43%, from 10.9% to 15.6%, over the study period from 1988 to 2003 (Data not shown. Source: DMDC personnel files, TAIHOD data, 2005). Because women tend, on average, to engage less frequently in certain high-risk drinking practices, it is possible that lower recidivism rates are explained, in part, by greater representation of women in the Army in more recent years. However, the data do not support this hypothesis. While the proportion of persons referred to ASAP who are women increased over the study period (58% increase from 5.8% to 9.2%) (Figure 1), this increase is larger than the actual increase in the proportion of women in the total population. This suggests that the gender difference in risk of alcohol referral is getting larger even after accounting for the growing number of females in the general Army population.

Figure 1. Percentage of female Soldiers evaluated for an alcohol-related problem in the ASAP compared to females in the general U.S. Army population, 1988-2003



<u>How does initial referral and outcome of evaluation relate to likelihood of subsequent repeat referrals for alcohol problems?</u>

Between 1988 and 2000, 96,685 Soldiers were enrolled in ASAP to treat an alcohol problem. Subsequent to enrollment, Soldiers were evaluated and their progress reported on report forms. The number of progress reports (or follow-ups) after enrollment ranged from 0 to 19 per Soldier. Most Soldiers (47%) had only one follow-up report, 26% had two, and an additional 26% had more than two. Some of the Soldiers enrolled in the program (18.3%) were referred and evaluated a second time, and of those re-evaluated, 76% were then re-enrolled in ASAP for either alcohol or drug abuse.

Likelihood of recidivism (future enrollments) was associated with the number of follow-ups for prior enrollment. Soldiers with five or more follow-ups after their first enrollment were more likely to be enrolled again for a new alcohol-related event than Soldiers with less than 5 follow-ups to their first enrollment (OR = 1.19, 95% CI = 1.11 – 1.28). Even using a cut-off of 3 follow-ups, we still noticed an increased chance of re-enrollment among Soldiers with more follow-ups: Soldiers with 3 or more follow-ups were slightly but significantly more likely than soldiers with less than 3 follow-ups to be enrolled again in ASAP (OR = 1.11, 95% CI = 1.07 – 1.16).

An association was also found between the likelihood of re-enrollment and the referral source from a Soldier's first evaluation/enrollment for alcohol. Enrolled Soldiers referred by Commander-directed biochemical testing were less likely to be enrolled again compared with enrolled Soldiers initially referred by other means (OR = 0.61, 95% CI = 0.54 – 0.68). This was also true for Soldiers initially enrolled after a DUI (OR = 0.64, 95% CI = 0.59 – 0.68). On the other hand, enrolled Soldiers who self-referred, or who were referred by a Commander, had slightly, yet significantly greater odds of future alcohol or drug enrollments (OR = 1.20, 95% CI = 1.15 – 1.25 and OR = 1.18, 95% CI = 1.13 – 1.23, respectively).

Table 24. Subsequent enrollments in ASAP according to source of referral at initial enrollment for enrolled active-duty Army Soldiers, 1988-2000.

	Subsequent ASAP Enrollments			
Source of Referral[a]	No Future Enrollments N=83,192 Row% Column%	Future Alcohol Enrollments (no drug) N=12,258 Row% Column%	Future Drug Enrollments (no alcohol) N=1,076 Row% Column%	Future Alcohol & Drug Enrollments N=159 Row% Column%
Commander/ Supervisor	84.6 27.9	13.9 31.1	1.3 33.1	0.2 33.3
Investigation/ Apprehension	86.1 20.9	12.6 20.8	1.1 19.9	0.2 20.1
Self Referral	84.4 24.3	14.4 28.0	1.1 24.5	0.2 25.8
Medical/Physician-directed referral	87.6 11.7	11.3 10.2	0.9 8.9	0.2 14.5
Driving Under Influence	90.3 11.1	8.9 7.4	0.8 7.2	0.0 2.5
Command-directed Biochemical	90.9 3.8	7.2 2.0	1.7 5.6	0.1 2.5
Other Source[b]	87.4 0.3	11.3 0.3	1.3 0.4	0.0 0.0
Family Referral	89.8 0.1	7.1 0.1	3.1 0.3	0.0 0.0
Security Clearance	78.2 0.1	16.4 0.1	3.6 0.2	1.8 0.6

[a]38 enrolled Soldiers did not have a listed source of referral at their first evaluation.
[b]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

<u>How often do Soldiers who were initially evaluated for an alcohol problem but not enrolled end up back in the system for second evaluation? How does the initial referral source relate to this?</u>

Of the Soldiers evaluated for an alcohol problem between 1988 and 2000, 70,140 were not enrolled. Of these, 22% (N = 15,228) were subsequently referred to ASAP at a later date for either an alcohol or drug evaluation. Among these re-evaluated Soldiers, 68% were then enrolled in ASAP for either an alcohol or drug problem (N = 10,391). Future enrollments for Soldiers not enrolled at their first evaluations were associated with the referral mechanism at their first event. For example, those originally referred because of Commander-directed biochemical testing were significantly less likely than other non-enrolled Soldiers to enroll after a future evaluation (OR = 0.77, 95% CI = 0.66 – 0.89), as were Soldiers originally referred because of a DUI (OR = 0.63, 95% C = 0.59 – 0.69). Soldiers not enrolled at their first evaluation, but who were more likely to be enrolled at subsequent evaluations, were those initially referred by a Commander (OR = 1.21, 95% CI = 1.16 – 1.26) and Soldiers who initially self-referred (OR = 1.35, 95% CI = 1.26 – 1.44).

Table 25. Subsequent enrollments to ASAP according to source of referral at initial evaluation for active-duty Army Soldiers not enrolled at their first evaluation, 1988-2000.

	Subsequent ASAP Enrollments			
Source of Referral	No Future Enrollments N=59,749 Row% Column%	Future Alcohol Enrollments (no drug) N=9,314 Row% Column%	Future Drug Enrollments (no alcohol) N=869 Row% Column%	Future Alcohol & Drug Enrollments N=208 Row% Column%
Commander/ Supervisor	83.5 30.8	14.8 35.0	1.4 35.1	0.3 32.2
Investigation/ Apprehension	85.3 28.7	13.2 28.5	1.3 29.0	0.3 26.9
Self	81.5 9.8	16.8 12.9	1.3 10.7	0.4 12.5
Medical/ Physician-directed	87.1 15.8	11.5 13.3	1.0 12.7	0.4 19.2
Driving Under Influence	89.7 11.1	9.4 7.5	0.8 6.9	0.1 3.9
Command-directed Biochemical	88.2 2.7	9.2 1.8	2.1 4.4	0.6 4.8
Other Source[a]	88.4 0.6	10.6 0.5	0.9 0.5	0.0 0.0

Source of Referral	Subsequent ASAP Enrollments No Future Enrollments N=59,749 Row% Column%	Future Alcohol Enrollments (no drug) N=9,314 Row% Column%	Future Drug Enrollments (no alcohol) N=869 Row% Column%	Future Alcohol & Drug Enrollments N=208 Row% Column%
Family	86.6 0.2	8.8 0.1	2.6 0.4	0.0 0.0
Security Clearance	87.0 0.4	11.2 0.3	1.5 0.5	0.4 0.5

[a]Other sources include Applicant/Accession Test, Mishap/Accident, Voluntary Test, and Adolescence Substance Abuse Counseling Referral, and all other unspecified sources of referral.

Reason for non-enrollment at the time of a Soldier's first evaluation was also associated with patterns of subsequent enrollment. Soldiers that were initially sent to ADAPT for a prevention program were more likely than other non-enrolled Soldiers to be later enrolled in ASAP for drug or alcohol abuse (OR = 1.24, 95% CI = 1.18 – 1.30). Soldiers not enrolled at their first evaluation because of Commander intervention were significantly less likely to have an eventual ASAP enrollment than other non-enrolled Soldiers (OR = 0.67, 95% CI = 0.62 – 0.73).

Table 26. Subsequent referrals to ASAP for active-duty Army Soldiers not enrolled at their first evaluation according to non-enrollment reason, 1988-2000.

Reason for non-enrollment	Subsequent ASAP Enrollments No Future Enrollments N=59,749 Row % Column%	More Alcohol Enrollments (no drug) N=9,314 Row % Column%	Future Drug Enrollments (no alcohol) N=869 Row % Column%	Future Alcohol and Future Drug Enrollments N=208 Row % Column%
Referred to ADAPT	84.3 64.8	14.2 69.8	1.3 68.2	0.3 62.5
No Alcohol or Drug Problem	85.7 20.1	12.7 19.2	1.3 20.3	0.4 23.6
Commander Decided not to Enroll	89.3 9.7	9.7 6.8	0.9 6.9	0.1 4.3
Referred to Other than Alcohol/Drug Service	87.0 3.9	11.1 3.2	1.3 3.8	0.6 8.2
Patient Refused Services	89.0 1.5	10.0 1.1	0.7 0.8	0.3 1.4
Prescribed Medication	88.2 0.1	11.8 0.0	0.0 0.0	0.0 0.0

DISCUSSION

Soldiers referred and screened for alcohol problems comprise a large and diverse population. Unadjusted analyses suggest that certain demographic factors are more common among Soldiers referred to the Army's alcohol evaluation program, including being single, young, male, white or Native American/Alaskan native, in the infantry, of low occupational rank, and having few years of education. These results are consistent with those reported in other studies of alcohol abuse and misuse patterns within the Army. Bray et al. found that young, single, less well-educated, non-Hispanic Whites, and lower-ranked Soldiers reported higher rates of alcohol consumption (12), and Williams et al. (2002) found that craft workers and infantrymen were more likely to abuse alcohol (50). These results suggest that the ASAP referral system is successful at detecting segments of the population who are at greater risk for alcohol abuse.

There is evidence of potential interactions between marital status and race in determining risk for alcohol-related problems. Black Soldiers referred to ASAP for an evaluation were significantly more likely to be married than single, despite the fact that blacks were only slightly more likely than other racial/ethnic groups to be married in the general Army population. Several studies have evaluated marriage as a modifier of the relationship between race and alcohol abuse (13, 14, 36), and several found that there are important differences. While whites who abuse alcohol have been shown to modify their behavior with age or when they marry, there is some evidence that this is not necessarily the case for blacks. For example, Mudar et al. (2002) found that alcohol consumption decreased among whites but not among blacks as they transitioned from being single to married (36). Our results support these findings.

There may be important gender and marital status interactions as well. Women referred to ASAP were significantly more likely to be no longer married than were men, although they were also more likely to be no longer married in the general population. There have been a number of studies examining the effect of widowhood, divorce, or separation on alcohol abuse. While several have found a positive association (38, 39), some have not. A review by the National Institute on Alcohol Abuse and Alcoholism in 1999 reported that drinking among women was found to be most common among the divorced (37), while *Harford* (1994), for example, found that divorce is associated with a *decrease* in short-term drinking for both men and women (27). Among a study by Gomberg (1995) of older problem drinkers, men were more likely to be married, divorced, or separated, while women drinkers were more likely to be widows (26).

Of those referred, 72% were under the age of 25. While the Army is disproportionately young--45% of enlisted Soldiers were under the age of 25 in FY98 (4) --the greater representation of younger Soldiers in ASAP is consistent with the literature, which documents increased risk for alcohol abuse among young adults up to about the age of 25, at which point it begins to taper off. Additionally, the armed forces may potentially appeal to more risk-taking individuals who may also be more likely to drink heavily. Also, the often dangerous and potentially stressful nature of being a

service member may lead Soldiers to drink more than their civilian counterparts (11, 12).

There are a number of avenues along which a Soldier with an alcohol problem might be referred to the Army's ASAP program for evaluation. Certainly the growing emphasis on detection and treatment of substance abuse in the military and civilian sectors has influenced the normative environment in which drinking occurs, as well as vigilance and motivation to intervene when a problem is detected. Commanders are instructed to identify substance abuse problems within their unit as a part of troop health and readiness. Therefore, it is not surprising that Commanders would be vigilant in observing any suspicious or unhealthy behavior, especially among newer and younger troops. Additionally, some Soldiers may engage in certain activities that would increase their chances for abuse detection. The relationship between alcohol and injury, for example, has been well-documented (7, 8, 23, 44). Soldiers who engage in more injury-causing activity are likely to have more healthcare visits and, therefore, more opportunities to have an alcohol problem medically detected. Also, Soldiers who drive more frequently than others have more opportunities for DUI and may be at greater risk of having a DUI-related referral to ASAP.

We found significant associations between individual demographic characteristics and source of referral. Soldiers under 21 were nearly 50% less likely to be identified through a DUI than older Soldiers. Since these younger Soldiers comprise a large proportion of the population referred to ASAP overall, this perhaps implies low levels of underage drinking and driving in the U.S. Army. But it may also be a function of under-reporting. By 1988, every state and, therefore, every military installation had raised their minimum legal drinking age to 21, implying that any Soldier under 21 years old caught drinking and driving would be charged with both a DUI and underage drinking. To avoid having to give these young men a double conviction, it is possible that they were released with only a warning. Other subpopulations, however, such as Hispanics and no-longer-married Soldiers, had greater odds of referral through DUI charges. They appear to be good target populations for drinking and driving prevention initiatives. Our finding that Soldiers with at least a college degree were significantly more likely than others to be referred after a DUI were based on unadjusted estimates. The association of age with college education may play a large role in explaining this finding.

We found that women were nearly twice as likely to be referred by a physician as were men. These findings appear to contradict research by D'Amico et al*.* (2005) that alcohol-related problems in men are more likely to be detected among general medical providers (21). However, our findings are compatible with research that claims women are more likely to seek help for alcohol problems through primary care physicians (6).

Our research contradicts Boscarino's findings regarding race and self-referral patterns. He found that blacks were more likely than other racial/ethnic groups to self-refer (10), while our data suggest greater odds of self-referral to ASAP among whites compared to blacks. Variations in education, employment, and insurance between races

are less pronounced in the military than they are in civilian populations, offering a potential explanation for these health-seeking differences between civilian and Army populations.

The demographic characteristics of Soldiers ultimately enrolled in the Army alcohol treatment program differ from those initially referred for evaluation of alcohol problems. Although this may reflect underlying differences in alcohol problems, it might also be a function of the way the ASAP program works. For example, Soldiers over the age of 35 have a relatively high probability of being enrolled in the ASAP program compared with the other heavy drinking age group, 21 to 25 year olds. This may be the result of the Army's practice of only enrolling Soldiers with a high likelihood of successfully completing treatment and returning fully functioning to the Army. It is also possible that a Commander will only enroll Soldiers who have already proven their ability to contribute to the Army and in whom the Army has already invested substantial training resources.

Nearly 43% of those evaluated for alcohol problems are ultimately not enrolled for treatment. For women, a high proportion of those not enrolled were referred for services other than alcohol- or drug-related treatment. This may reflect a failure to detect mental health and social problems and a misdiagnosis of these problems as substance abuse disorders. It may also be an indicator that women experiencing significant psychological trauma self-medicate with alcohol.

Soldiers younger than 21 who were not enrolled were mostly referred to prevention training. Perhaps ASAP evaluators see alcohol-related encounters in young Soldiers as episodic rather than a marker for a more serious problem. Similarly, Soldiers with no greater than a high school qualification were more likely to be referred to prevention training than non-enrolled Soldiers with higher educational levels. Since our analyses were not adjusted, this may be due to the fact that younger Soldiers typically have lower levels of education than older Soldiers.

Non-enrolled higher-ranking officers were over ten times as likely to be referred to services other than for substance abuse. This dramatic difference might reflect a reluctance to label a high-ranking officer with an alcohol problem due to their status or out of concern for the possibly more significant consequences. An officer with a substance abuse problem might be more likely to be discharged than lower ranking Soldiers with a problem.

The assessment of source of referral and enrollment decision may help identify means of referral that are most successful in detecting Soldiers with alcohol abuse problems in need of treatment. Not surprisingly, self-referred Soldiers were nearly three times as likely as those referred by others to be enrolled for treatment in ASAP. Soldiers initially referred by family members were significantly less likely than Soldiers referred by other mechanisms to enroll in ASAP. Instead, they were usually referred to other services. It may be that the problems identified by family members, warranted family, marital, or individual psychological counseling. It might also be that those who

self-refer have more serious alcohol-related diseases than those referred via other mechanisms. In addition, the association between self-referral and recidivism might also suggest that Soldiers referred through these mechanisms are sicker.

Of the Soldiers referred medically or by a physician, only 51% were enrolled in treatment programs; this was significantly less than other referral sources. Of the medically -referred and not enrolled, 33% were deemed by the ASAP evaluation counselor not to have an alcohol problem. This discrepancy between the judgment of the doctor and that of the ASAP counselor deserves to be explored further. Civilian studies have identified problems with physician detection of alcohol abuse (22, 46).

Of Soldiers initially referred for evaluation after a DUI, 44% were not enrolled in alcohol treatment. The majority of them (86%) were referred to a prevention training short course. This, however, may be inappropriate. A pilot study of a DUI program at Fort Bliss in El Paso, Texas, in 1984 found that 88% of Soldiers apprehended for a DUI met criteria for either alcohol dependence or alcohol abuse (34). If this finding is generalizable to the entire Army population, it raises questions about the adequacy of screening and intervention for Soldiers referred for evaluation after a DUI. A short course in the prevention of alcohol abuse may not be sufficient treatment.

Patterns of recidivism could be useful to indicate success of treatment and the accuracy of enrollment decisions and/or referral sources, but this interpretation is complicated by lack of information on severity. We found that Soldiers who received more follow-up care at their first enrollment were more likely to re-enroll at a later date. This may imply that the Soldier did not receive adequate care during their first enrollment in ASAP. The number of follow-up visits may be a proxy for severity of the alcohol-related problem, and those with more severe problems are less likely to make a successful recovery and more likely to experience a repeat event. Moreover, Soldiers followed more closely after an enrollment may be more likely to have problems detected again.

Random biochemical testing does not generally identify many alcohol abuse cases, and those few it does detect are probably not the most severe judging from the recidivism rate. The cost-effectiveness of this screening strategy may need to be reassessed.

While referral through legal investigation was not found to be significantly associated with future enrollments, Soldiers enrolled after a DUI charge at their first ASAP encounter were less likely to re-enroll than Soldiers originally enrolled by other referral mechanisms. This finding may suggest that legal intervention has a positive impact on curbing adverse behaviors such as alcohol abuse, supporting research by Atkinson et al. (2003) that found legal intervention to be an indicator of successful treatment completion (5). However, the decreased likelihood of re-enrollment by these Soldiers may be a function of dismissal from the Army. It may also simply be an artifact of the covariance between level of disease severity and mechanism for referral. That is, young male Soldiers (the group at highest risk for DUI) may engage in drinking and

driving behaviors as part of a constellation of high risk activities which, though dangerous, may not necessarily be indicative of alcohol dependence or an alcohol-related disorder. Thus, they may be more easily “treated” and/or may be more likely to age out of the behaviors than Soldiers with alcohol dependence, which would also make them lower risk for recidivism.

Soldiers who self-referred for an alcohol evaluation were more likely to re-enroll at a later date. This was true of both Soldiers who self-referred and received treatment (were enrolled) and Soldiers who self-referred but were not enrolled. Both groups had significantly higher rates of repeat evaluations and enrollments. The Soldiers who self-referred but were not enrolled believed that they had a substance abuse problem. They were turned away from treatment services through the ASAP, though they still remained in the Army long enough to be evaluated again. Their recidivism rates imply that Soldiers who admit to alleged substance abuse problems should perhaps be treated more frequently and aggressively. Self-referral may also be a marker for more advanced disease progression and/or disruption of social supports that might lead to help-seeking behaviors.

Soldiers who were referred by a Commander for an initial evaluation but who were not enrolled were less likely to enroll in the future. Since we cannot account for dismissal from the service–whether honorable or dishonorable–we cannot rule out the possibility that these Soldiers simply did not remain in service. On the other hand, Soldiers who were initially referred by their Commanders and *enrolled* at that first evaluation had greater odds of recidivism. This could speak to the fact that the Army believed these Soldiers were worth retaining (since they were enrolled in the first place) to the point that they would enroll them again. Or it might reflect disease severity. It is possible that Commanders are more likely to notice more severe cases of alcohol abuse, to refer the Soldier, and to approve treatment. If a Soldier’s alcohol problem is interfering with their work and service duties, it is probably significant enough to warrant both Commander attention and treatment; in these circumstances, continued treatment is measured by multiple enrollments in ASAP. Soldiers referred by a Commander and enrolled for treatment may be sicker than other Soldiers and thus at greater risk for relapse.

Soldiers who were not enrolled but instead sent to ADAPT for prevention training were more likely than enrolled Soldiers to experience a second alcohol-related event and be enrolled in the future. This raises questions about the effectiveness of the prevention training program and/or of the initial screening. It appears that either these Soldiers should have been enrolled in ASAP in the first place, or that ADAPT training needs to be improved. It may be, however, that some Soldiers who attend ADAPT training and have no further troubles with alcohol may simply age out of the behaviors and perhaps would have done so with or without the training. This is further supported by our finding that Soldiers under 21 were more likely to be sent to ADAPT prevention training in lieu of enrollment. Further research, controlling for these potential threats to validity, are needed to better evaluate the effectiveness of ADAPT.

Soldiers not enrolled because of Commander intercession were less likely to return to ASAP for evaluation. This may be because these Soldiers changed their drinking habits. Perhaps Commanders perceived these Soldiers to be a poor risk, unlikely to recover and contribute to the military effectively, and they were discharged. Since our study does not adjust for time in service, we cannot know if these Soldiers remained in the Army without a subsequent drinking incident or, in fact, if they were discharged from the Army. More research is needed to better characterize the longer range outcomes of those not enrolled in the treatment program.

STRENGTHS AND LIMITATIONS

This is a descriptive study using existing, secondary data sources and, as such, there are some important data limitations. It has not been possible, for example, to make adjustments to account for Soldiers who are discharged from the Army, or who may have died while on active duty. As a result, we are unable to discern whether a lack of subsequent enrollment implies recovery, death, or discharge. In addition, because data are cross-sectional, it is not possible to assert any causal relationship between variables that can change, such as marital status and alcohol problems.

The demographic breakdown of the Army is quite different from that of the general U.S. population, with the Army predominantly male, younger, and with a greater representation of minorities than the civilian population. Moreover, our population is unique in that all its members are employed and have access to health care through Army-sponsored health insurance. The unique demographic make-up of the Army may limit the applicability of this study's results to the general civilian population, as well as explaining why the Army results have sometimes differed from findings in the wider population.

A major strength of this study is the large sample size from which our conclusions were drawn. Most studies that have examined the characteristics of individuals referred and/or enrolled in civilian alcohol treatment programs have been limited in size and, therefore, power. Additionally, the many components of the TAIHOD provide an opportunity to link Soldiers' demographic and health-related data at the level of the individual. This study provides the first overview of the demographic characteristics of this large population of alcohol referees and enrollees.

CONCLUSIONS AND RECOMMENDATIONS

- Our findings illustrate the strengths of the current ASAP and reveal areas for improvement.

- These results suggest that, overall, the demographic profile of those being referred to ASAP and treated for alcohol problems matches those of high-risk alcohol abusers found in other studies.

- Soldiers who were single, young, male, of lower rank, of lower education, in the infantry, and not black were all more likely to be referred for alcohol abuse evaluations. Commanders and physicians should be aware of these characteristics when they identify Soldiers to be evaluated for substance abuse, but also keep in mind that alcohol abuse crosses all demographic boundaries.

- The three most common ways Soldiers were referred to ASAP for an alcohol evaluation (accounting for 70% of all referrals) were Commander or supervisor recommendation, legal investigation or apprehension, and self-referral.

- Different referral processes seem to reach or target different demographic subgroups of the population. Male Soldiers were much more likely than female Soldiers to have been referred for evaluation as a result of an investigation, and were also more likely to be referred as a result of drinking under the influence. Female Soldiers were more likely to have self-referred, to have a medical referral, or be referred by family. It may be useful to social services on posts to consider whether their alcohol screening and detection programs may be missing certain demographic subgroups. This information should also be applied to increase both the sensitivity and specificity of screening techniques.

- Marital status may modify the association between race and alcohol enrollment, and gender and alcohol enrollment. More research is needed to evaluate these potential interactions.

- Hispanics and no-longer-married Soldiers were both more likely than others to be referred to ASAP for evaluation following a DUI charge. This finding indicates the need for more research into the etiology of this association and possibly the need for targeted prevention efforts.

- Only Soldiers who are considered retainable and who have demonstrated good potential to return to duty and contribute to the service were enrolled. These are usually Soldiers in whom the military had already invested resources, but who are not too close to retirement. For example, while Soldiers under age 30 were more likely to be referred for evaluation, Soldiers over 30 were more likely to be enrolled in ASAP.

- Approximately two-thirds of non-enrolled Soldiers were instead referred to ADAPT for prevention training education. Evaluators found 19% of non-enrolled did not have a substance abuse problem and Commanders decided against enrollment for 9% of the non-enrolled.

- Soldiers referred either medically or through an investigation were less likely than Soldiers referred through other mechanisms to be enrolled in ASAP. Soldiers who were enrolled following a DUI were less likely to have a subsequent enrollment. Usually this was because these Soldiers were either found not to have an alcohol-related problem, or the problem was considered minor enough that referral to the

ADAPT prevention training education short course was sufficient. Some of these Soldiers may have been discharged from the Army.

- Soldiers referred to ADAPT in lieu of enrollment in ASAP were more likely to have a second incident resulting in enrollment in ASAP for drug or alcohol abuse. This raises questions both about the effectiveness of ADAPT as a prevention program and about the accuracy of enrollment decisions of the Commander and/or ASAP counselor at a Soldier’s first evaluation. The current ADAPT curriculum might need to be revised or implemented more aggressively, or the screening process may need to be reviewed for deciding on enrollment in a more formal treatment.

- Self-referred Soldiers who were not enrolled at their first evaluation were more likely than Soldiers referred by other mechanisms to be enrolled at a later date following a subsequent evaluation. It is possible that self-proclaimed alcohol abusers are not receiving proper attention or treatment after their first evaluation. Treating these individuals sooner may expedite rehabilitation and a more productive return to duty.

- Further research is needed to more fully explore and evaluate the health, behavioral, and occupational outcomes of Soldiers referred to and enrolled in ASAP. The analytic approach elected to conduct such a study will need to include a means of measuring and controlling for dismissal from the Army during the follow-up period.

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REAL WORLD RESEARCH FOR FAMILY ADVOCACY PROGRAMS

Social-Cognitive Theory Applied to Maltreating Parents An Interview with Sandra T. Azar, PhD

James E. McCarroll, PhD (EM)

In This Issue

As practitioners, researchers and advocates working in the field of family violence, we must continually strive to examine new models that can help us better interpret, educate and treat our clients. The fall issue of *Joining Forces Joining Families* features the work of Sandra T. Azar, a noted psychologist from Penn State University. Dr. Azar's work focuses on social-cognitive theory as applied to maltreating parents.

Using data from the Army Central Registry and the Health Risk Appraisal, Nicole Bell and Cara Fuchs show the importance of considering both past and current alcohol drinking practices on spouse maltreatment.

Our statistics article provides some guidelines on understanding and interpreting the differences between data obtained from (1) enumerating and (2) estimating an event. Both types of data are frequently quoted when describing spouse or child maltreatment. Websites of Interest gives some examples of data described in the statistics article as well as sources of information on maltreatment statistics.

—*James E. McCarroll, PhD, Editor-in-Chief*

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Dr. Azar is a clinical psychologist and a Professor of Psychology at The Pennsylvania State University where she teaches and conducts research. She received her PhD in psychology from the University of Rochester in 1984. Her distinguished career includes membership on the editorial board of numerous scientific journals and she has received many federal grants from the U.S. and Canada. Her research interests include child abuse and neglect, gender and aggression, parenting, family interactions, developmental aspects of self-control, adolescent depression, and legal processes and families. Currently, her work centers on the relation between cognitive processes and parenting, particularly under adverse conditions such as poverty and parental disability.

EM How did you get started in child maltreatment work?

Dr. Azar: My first studies as an undergraduate were on memory and the role of cognitive mediation. That's where my interest in social cognition came from, but even then I was interested in poverty and at-risk children.

EM: You have worked in many different areas of child maltreatment.

Dr. Azar: Child maltreatment is an interdisciplinary topic and includes pediatricians, social workers, public policy people, and others.

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The field just does not lend itself to a traditional psychological approach.

EM: How would you explain the concept of child maltreatment to a lay audience, to people who say "How could this kind of thing happen?" or "How could somebody do that?"

Parenting is a very complex cognitive task. We underestimate that fact.

Dr. Azar: Parenting is a very complex cognitive task. Often, we just say, "Parenting is instinct." Parenting is a job, but often in our society we do not see it that way. Parents have to juggle: "The kid needs to learn how to keep his shoes tied. I've got to get the other three children to school. I'm tired. They kept me up last night because one of them had a fever." Each of those stresses requires cognitive capacity to solve. But, when you put them all together in individuals who may be limited in some capacities or may have difficulty being flexible, the task becomes impossible.

There are multiple causes for child maltreatment. In some cases I see it as a learning deficit. Some people have grown up in families where the standards for parenting are different from the norms of the rest of society. These parents are isolated and lack resources and social support and have distorted scripts for the parenting process. They may misinterpret a child's behavior, which can lead them to a perception of exceptional malevolence on the child's part. They may think, "This child is doing this on purpose and is trying to get to me." That kind of appraisal will heighten their arousal and lead them to do things they might not otherwise engage in.

EM: How do you work with a parent who experiences those distortions?

Dr. Azar: All my work has been aimed at challenging those distortions, but it's a very tricky task. To them, their distortions are as familiar and as natural as breathing. As a result, you have to produce lots of exemplars before people shift their thinking and are willing to realize that it is their thinking gets them into trouble.

The process that I use can work in ten or twelve weeks with home visitors and groups. Groups are very important because people are much better at seeing distortions operating in other people than in themselves. If people can engage in the process of exploring why they are in trouble and how they might change their behavior, you can change these distortions in a short span of time. But, you need to be very skilled at *tenderly* moving them through the challenging process.

The work involves modeling. I show them how thoughts influence behavior. Different thoughts produce very different outcomes. I get them to help me think about generating their ideas. I may present scenarios. For example, "You save up for weeks to buy a new white dress, and you are very happy wearing it. Then little Johnny comes toddling toward you with this glass of red cool-aid and spills it all over your new white dress." I get them to imagine very slowly that situation and ask them to tell me what they are feeling physically and then what is going on in their head. "What thoughts are you having about Johnny?" Typically, you get things like, "It's not fair. Why me? I never get to have nice things. This kid really doesn't care. He did this on purpose. He's just like his father." I will try to give some links to other people in their lives who do not care about them or who treat them unfairly. Then I will work on discriminating the child from those other people and teaching them self-statements that will cool the fire of their anger and frustration with the child. Examples are, "He's only two. He doesn't know any better. It's my job to

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JOINING FORCES
Joining Families

Editor-in-chief
James E. McCarroll, Ph.D.
Email: jmccarroll@usuhs.mil

Editor
John H. Newby, DSW
Email: jnewby@usuhs.mil

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Editorial Advisor
LTC Mary Dooley-Bernard, MSW
Family Advocacy Program Manager
Headquarters, Department of the Army
E-mail: Mary.Dooley-Bernard@cfsc.army.mil

Editorial Consultants
David M. Benedek, M.D., LTC, MC, USA
Associate Professor and Scientist
Center for the Study of Traumatic Stress
Uniformed Services University of the Health Sciences
dbenedek@usuhs.mil

Nancy T. Vineburgh, M.A.
Director, Office of Public Education and Preparedness
Center for the Study of Traumatic Stress
Email: nvineburgh@usuhs.mil

The Social-Cognitive Theory of Parenting
A Brief Review of the Work of Sandra T. Azar

Her work advances an assessment approach that focuses on parental behavior and functioning as opposed to a model that emphasizes personality and intelligence.

James E. McCarroll, PhD

Dr. Sandra T. Azar is widely published in the topics of child maltreatment and parenting. She has written extensively on the termination of parental rights by the courts due to child maltreatment. She advises mental health professionals to be extremely cautious in their evaluations and statements because of the lack of data that exists in this arena. Such caution is particularly advised given the diversity of today's families and the fact that existing databases on families are largely based on studies of middle class, two-parent families and lack information on single parents, low socio-economic class families, very young families, or other complex family situations.

Her work advances an assessment approach that focuses on parental behavior and functioning as opposed to a model that emphasizes personality and intelligence. Accordingly, she strongly encourages more research in building a more extensive database of information about families and parenting. She believes that many current models are inadequate to explain the processes involved in parenting and that a newer, broader model is needed.

Her model is cognitive-behavioral and is based on the principle that thoughts influence behavior. Parenting is viewed within a general stress-coping model, which examines what the individual brings and what is required. Expectations about the self tend to be flexible and allow a wide range of enactment of the role of parent. She asks, "Is parenting a doable task? If so, what are its demands?" The social and cognitive tasks to be negotiated are *relational* and generally involve capacities that are required for many domains of adult development. The emphasis in her model is on improving the capacity to problem-solve and to remain cognitively flexible in the face of changes in the child and the changing contexts of life. Having realistic expectancies for the parenting role and the capacity to recognize where these expectancies may be ineffective and to re-adjust them are key to parental development. Her cognitive-behavioral model will work across the many varying circumstances of parenthood in today's world in that it does not require a biological basis, just the capacity to learn the parental role and to have gone into it with accurate perceptions of what that role entails.

The following review is taken from a chapter entitled "Adult Development and Parenthood" (Azar, 2002) in which Dr. Azar describes her perspectives on parenting. Additional references are provided.

How does one learn to be a parent?

Azar reviews two opposing theories of parenthood. The first sees parenthood as a stage in normal adult development. In this view, parenting is seen as essentially instinctive. As a result, criticism of the parent is highly likely in the event of failure. (How could one fail at something that is instinctive?) Azar argues against the parenting-as-normal-development theory. She presents the view that an individual's life course is flexible, random, and driven by context. Parenting, a unique context for the development of psychological maturity, involves stresses that can lead to personal growth or to maladaption. For some, parenting may be overwhelming and result in child maltreatment, depression, and other negative outcomes. For others, the stresses of parenting are within their "developmental reach" and this stage can lead to personal growth, greater maturity, and improved parenting skills.

What affects parenting?

In Azar's view there are three major areas that impact parenting. The first is the environment (or the context of parenting). Differences in parenting would be expected in a high-crime area compared to parenting in the suburbs in terms of how much control is exercised over a child. The second is the child. Different parenting strategies and challenges would be expected for a special needs child, an adopted child, a foster child, or a child from a spouse's previous marriage. The third area is that of the parents. In today's world, there are many decisions to be made about parenthood and the role requirements imposed on parents by society. The heterogeneity of the parental role defies narrow boundaries typically seen in developmental literature. She addresses the Whether, Who, How, When, Where, and How Long of parenting. Each of these is a question and a choice point to be considered in assessing their impact on the relation between the parents and the child.

In summary, the heterogeneity of the parental role defies narrow boundaries typically seen in developmental literature. Azar shows how the social-cognitive model of adult development applies to parenthood across all these variations.

Whether, why, and when to become a parent?

In the U.S., the number of persons marrying has declined, the age of marriage and the age of the parent at the birth of the first child has increased, but these vary by ethnicity. Children used to provide old age security for parents. In some cases, this is still true, but in highly industrialized countries, less and less so. Teen parenting, once a norm in the U.S., is now considered a hazard. On the other end of the scale, technology makes parenthood possible for older and older people. Both of these age differences can create "out of sync" parents. These differences have implications for the parent's role expectations for their children.

Who becomes a parent?

Parents today include biological, teenage, adoptive, foster, grand, and gay and lesbian parents and a child may live with any of these as a single parent. Cultural practices, social class, and race and ethnicity interact with all the categories of who becomes a parent. An increasing number of families live in poverty. Most parenting studies have focused only on mothers. Data on fathers as parents is extremely lacking, especially in minorities and lower socioeconomic class families.

How does one become a parent?

Many new scientific advances can transform the origin of parenthood: artificial insemination, implantation, and fertility treatment. In addition to standard adoption, international adoption involving children of different races, ethnicities, and cultures is prevalent.

Where is one a parent?

Location can facilitate or restrict assess to physical resources needed to parent. Suburban, rural, and high crime areas: each influences the range of parenting behaviors and a child's response, both to the parenting and to the environment.

How long is one a parent?

The traditional idea that parenting continues only until the child leaves home is also undergoing change. Depending on culture and economic circumstances, children take parents into their homes and vice versa. Foster care is another example of both implicit and explicit time limitations on parenting, neither of which may be clear to the child or to the foster or biological parents. These differences and their impact on nurturing are not well understood.

In summary, the heterogeneity of the parental role defies narrow boundaries typically seen in developmental literature. Azar shows how the social-cognitive model of adult development applies to parenthood across all these variations. The basic assumption of this theory is that for development to occur, the role requirements must be within the adults' zone of proximal development. This model explains the learning of parenting skills in the context of social relationships as well as the set of capacities that might be needed to confront the disturbances in social and emotional functioning and contextual factors that can interfere with it. Such social and cognitive factors play a role in adult competence, well-being, self-efficacy, and life satisfaction.

Dr. Azar's work provides a multitude of suggestions for research and clinical practice in the assessment of parenting. For example, managing the many stresses of life in today's military is a cognitive and social challenge. Army soldier and family programs might gain from using Dr. Azar's social-cognitive theory to (1) describe and (2) seek pathways that can contribute to growth and prevent disruption of personal development.

Additional Reading

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Heavy Alcohol Consumption and Spouse Abuse in the Army

Nicole S. Bell, ScD, MPH, and Cara Fuchs, MPH

Heavy drinkers are also at greater risk to perpetrate spouse abuse even though alcohol may not have been consumed prior to the abuse event.

Dr. Nicole Bell received her Doctor of Science degree from Harvard University in 1994 focusing on program evaluation, injury epidemiology, and biostatistics. She is the principal investigator for two ongoing studies of alcohol and injury-related events, one funded by NIH to explore alcohol abuse and intentional injury, the other funded by the Department of Defense to assess alcohol abuse and serious injury and repeat injury events among active duty Army soldiers.

Ms. Cara Fuchs received her BA in Psychology from Tufts University in 2000 and her MPH in Epidemiology from Boston University in May of 2005. She has focused on projects investigating the relationship between alcohol use and intentional injuries among US Army personnel. This fall she will begin a clinical psychology PhD program at University of Massachusetts, Boston, where she will pursue her research interest in the psychological consequences of traumatic life events.

Spouse abuse is an important, preventable health and social problem encountered among both civilian and military couples. Among military families, abuse not only causes extensive emotional and physical harm to the family members and the surrounding communities, but also may decrease mission readiness. Rates of abuse among military and nonmilitary spouses appear to be fairly comparable once differences in race, gender and other factors are taken into account. [1] However, specific patterns of spouse abuse and various risk factors, such as alcohol abuse and military deployments, are less well documented and understood.

There are both direct and indirect links between alcohol and spouse abuse. Heavy drinking has been associated with abuse events where the perpetrator or the victim (or both) have been drinking as well as with abuse where neither party has been drinking. [2–4] There are also indirect associations between alcohol and spouse abuse. Individuals with alcohol dependence might experience personality changes that increase risk for abuse even when they have not been drinking. [5] Research emphasizing the importance of typical drinking on the perpetration of spouse abuse suggests that couples with alcohol problems are more prone to conflicts with their spouses, but conflicts that escalate to violence do not necessarily need to involve alcohol. [6] It may also be that heavy drinking covaries with other behaviors or social norms, such as lack of impulse control, aggression or gender models idealizing power.[7]

Alcohol abuse may not only increase the likelihood of abuse occurring, it may also result in more severe abuse. A study of 11,870 male, active-duty Army soldiers cohabitating with a partner on 38 US Army bases, found that compared to male soldiers who were mildly physically aggressive towards their partner in the previous year, male soldiers who were severely physically aggressive were more likely to report an alcohol problem. [8] A recently published study of the relationship between alcohol consumption and spouse abuse among enlisted, male U.S. Army soldiers found that soldiers who drink heavily are more likely to abuse their spouses both when they are and when they are not drinking alcohol. [2] A history of heavy drinking was also associated with spouse abuse even when drinking habits were measured years prior to the abuse. Put another way, women who live with heavy drinkers are more likely to be victims of interpersonal violence.

Participants in this study were all active duty, male, enlisted Army spouse abusers identified in the Army's Central Registry who had also completed an Army Health Risk Appraisal Survey between the years of 1991 and 1998 (n=9,534). Their data were compared with that of 21,786 controls who were matched on gender, rank, marital status and who had also completed an HRA.

This was a case-control study since the subjects were selected on the basis of the outcome (spouse maltreatment) and then differences in prior exposure (alcohol abuse) were examined. However, it is important to note that the key exposure data (alcohol consumption history) reported on health behavior surveys was measured prior to and independent of the spouse maltreatment event. This is an important strength of this study because the measurement of alcohol drinking behaviors was not influenced by the spouse abuse event as is possible during cross-sectional studies when both the outcome and the risk factor are measured at the same time.

Heavy drinking is associated with spouse abuse even when drinking habits were measured years before the abuse.

***Heavy Alcohol Consumption**, from page 5*

Those who were classified as the heaviest drinkers, 22 or more drinks per week, were 66 percent more likely to abuse their spouses than those classified as abstainers. In addition, moderate (8 to 14 drinks per week) and heavy drinkers (15 to 21 drinks per week) were three times as likely, and light drinkers (1 to 7 drinks per week) were twice as likely, as soldiers who report they typically consume less than one drink per week, to be drinking during the time of the abuse.

The study's findings argue for early identification of heavy drinkers in order to provide treatment that may significantly reduce the consequences of the drinking, including spouse abuse. The findings also argue for further research between drinking and abuse, particularly for the relation between drinking, spouse abuse, and child abuse. While an abuse event may not be associated with alcohol misuse, careful exploration of an offender's history of drinking may also provide useful clinical material.

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There is a high overlap between child abuse and domestic violence so we have to be very frightened for children in such situations.

***Interview with Sandra T. Azar** from page 3*

stay calm in these moments." Then I help them problem-solve. "What could I do next time to prevent this?" For a while during the therapy the child is invisible. It is the parents' needs, their wishes, their hopes, their thoughts that take prominence. It is my job is to help them see how those thoughts are detrimental.

I always tell my clients, whether they are child abusers or not, that they have to be the central character in their story. When they stop being the central character in their story then they are just reacting to everything around them as opposed to creating the action.

A lot of the work involves metaphors. Metaphors help people process and retain information.

EM: Can you give us examples of some of your favorites?

Dr. Azar: In trying to explain the concept of child development and age-appropriate tasks and behaviors, I might approach a mother and place something in front of her. I'll say, "Here's a carburetor. I want you to fix this carburetor." And the mother will laugh and look at me. I then say, "Don't laugh! You cannot leave this room until you get this carburetor fixed." (Occasionally, I run into one who can.) I use that metaphor when a mother brings up a developmentally inappropriate behavior she has demanded in a child. I'll say, "Maybe you are asking him to fix a carburetor. That's what it is like for children."

EM: How would you recommend that people measure parenting?

Dr. Azar: Parenting may not be the core of the evaluation. First and foremost should be a careful, functional, analytic view of the incident that precipitated their being identified. Try to understand its antecedents and look for clues from that. One can ask, "What specifically does

When a mother brings up a developmentally inappropriate behavior she has demanded in a child, I'll say, "Maybe you are asking him to fix a carburetor. That's what it is like for children."

this parent have difficulties with? Is it discipline? Is it daily organization of the child's life? Is it providing nutritious meals?" There may be hundreds of parenting education classes, but they do slightly different things and often there is no recognition of the specific needs of the parents. Another problem may be the way in which material is presented. Some parents have learning disabilities. We need to present information in multiple modalities to help them process it. In some cases, you can role-play and be more active in the intervention as opposed to giving a lecture about how children develop.

I talk about kid's "paycheck." Parents pay kids for things they *do not* like to see. If the kid has a choice between playing quietly and hitting his sister and the parent's attention is the paycheck, then they are going to hit their sister because Mom will be over there in a second. I try to illustrate the importance of reward and praise to keep a behavior going. You have to be a bit charismatic and approach parents in ways that they have not been approached before, such as by legal and child protection people. Parents have to believe that you think that inside there is a good person.

Therapeutic practice requires an engagement process with parents. That means hearing their definition of what their difficulties are and how they frame the problem and then trying to link that frame to what we know may be core etiological factors The parent's cognitive map is so important. What we present is not going to register is their schema about parenting is disparate from the helper's view.

EM: What are the most crucial needs in the child maltreatment field?

Dr. Azar: We need more research. It is hard to get funded as a child abuse researcher because we don't have a diagnosis like those who study depression or schizophrenia. It's harder to define what our problem is.

There is also a lack of dissemination of research results. We have some very promising approaches for assessment and intervention. In spite of existing empirical data, much of what is being carried out in most localities does not fit those models.

EM: Do you see public policy regarding child maltreatment focusing on the right problems?

Dr Azar: The recent addition of family violence into the Centers for Disease Control has been a good policy move. Placing family violence in the bailiwick of public health is a good public policy move. This is one of the ways we can help to fortify families to strengthen them against risk.

EM: Can you tell us a little of what you are working on now?

Dr. Azar: I am trying to explore some elements of cognitive incapacities that might produce risk to children. Here, I am focusing on neglect, not on child abuse. However, I do not see child abuse and neglect as disparate. They are both failures in judgment. One involves a little more impulsivity; the other a little more passivity in terms of children's needs. They both involve not being able to identify problems and respond to them appropriately.

EM: I certainly appreciate your time. You have been very generous We will all look forward to your continued good work.

Dr. Azar: Thank you. Take care, bye

Important Websites on Maltreatment Statistics

There are many websites that present statistics on child and spouse maltreatment. Such websites are sponsored by a variety of organizations: government, professional organizations, advocates, and others. As emphasized in the article on statistics in this issue of JFJF, the reader should be aware of (1) the purpose of the website, and (2) the source of the statistics. The latter point is particularly necessary to keep in mind when citing research information obtained from the Internet as, unfortunately, many organizations present data without giving its source.

- The National Criminal Justice Reference Service (NCJRS): **http://www.ncjrs.org**. This website is maintained by the U.S. Department of Justice. Within the vast amount of material presented here, most statistics of interest are under the two sections entitled "Victims of Crime" and "Statistics". One can obtain full text publications here, which can be very valuable because they are not as limited in space as are journal articles and book chapters. They provide reports from the most recent major prevalence study of domestic violence in the U.S. by Tjaden and Thoennes. Note that there are two reports, one in July 2000 (The Extent, Nature, and Consequences of Intimate Partner Violence) and November 2000 (Full Report of the Prevalence, Incidence, and Consequences of Violence Against Women). These are comprehensive reports of telephone surveys of 8,000 women and men to questions on domestic violence including rape and assault. They are found under the numbers NCJ 181867 for the July 2000 report and NCJ 183781 for the November 2000 report.

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How is Maltreatment Measured?

James E. McCarroll, PhD

In this article we wish to draw a distinction between data that are obtained by (1) counting an existing population (e.g., the number of abused children annually reported to authorities) and (2) estimating from a sample (e.g., the number of spouse abuse victims, annually or lifetime, in the U.S.). Both can be referred to as statistics, but their sources and interpretation are very different.

Descriptions of maltreatment, particularly spouse abuse, are usually given in a numerical format: number of victims, how often victims are abused (e.g., so many every minute), number of homicides, and many others. Such descriptions may represent two different concepts and types of measures. In this article we wish to draw a distinction between data that are obtained by (1) counting an existing population (e.g., the number of abused children annually reported to authorities) and (2) estimating from a sample (e.g., the number of spouse abuse victims, annually or lifetime, in the U.S.). Both can be referred to as statistics, but their sources and interpretation are very different.

Some events can be counted and expressed as frequencies (the number counted), proportions, percentages, or ratios. Examples of population count data are the annual report from the states on child maltreatment to the U.S. Department of Health and Human Services (published annually as *Child Maltreatment)* and the Federal Bureau of Investigation's *Uniform Crime Report*. (For more information on these publications and their use, see Websites of interest in this issue of JFJF.)

On the other hand, other statistics may provide a model of a phenomenon that is difficult or impossible to measure directly. There is no national spouse abuse reporting system (as there is for counting child maltreatment) and states vary in their laws, definitions, and mechanisms for reporting spouse abuse. Therefore, a population estimate seems to be the best way to describe the number of spouse abuse victims. Surveys have been conducted to estimate this number, but they are expensive, usually provide data on only one time point, and may suffer from methodological problems such as difficulty obtaining a representative sample. Two examples of population estimates are the Straus and Gelles (1986) and the Tjaden and Thonnes (2000) studies. Both were well-designed and well-conducted large-scale studies that provided population estimates of domestic violence using the Conflict Tactics Scale (CTS) (Straus, 1979), although different versions of the CTS were used in each study.

The reader who wishes to compile and report statistical data on the frequency or rate of spouse or child maltreatment data must pay attention to (1) the measure used, and (2) whether the frequency or rate is given for the sample studied or for the population as a whole.

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Important Websites on Maltreatment Statistics (continued)

- The Office of Violence Against Women: **http://www.ojp.usdoj.gov/vawo/**. This website is also maintained by the Department of Justice and includes information about the Office of Violence Against Women including announcements for events (such as conferences), new initiatives, press releases, publications, and laws and regulations. A section entitled "Information About Sexual Assault" includes medical information, reporting procedures, resources, and lists of state sexual assault coalitions and hotlines.
- The Uniform Crime Reports (UCR): **http://www.fbi.gov/ucr/ucr.htm.** The Federal Bureau of Investigation maintains this website, which contains crime data. The UCR is a report of the compilation of the volume and rate of crime offenses for the nation, the states, and individual agencies. Note that this is crime data reported to the Federal Bureau of Investigation. It is sometimes hard to locate family violence data on this site. "Intimate partner violence" is the best search term for locating such information.
- *Child Maltreatment, 2003*: **http://nccanch.acf.hhs.gov**. *Child Maltreatment* is an annual publication that provides state-by-state counts of child maltreatment as reported to state child protective agencies and summarized at the national level. It includes the number of children abused or neglected by sex, age, ethnicity, disability, location, type of perpetrator, and other factors on child maltreatment.

CAUSES AND NATURE OF INJURY AMONG ARMY SOLDIERS HOSPITALIZED WITH ALCOHOL COMORBIDITY

Jonathan Howland, PhD, MPH, Nicole S. Bell, ScD, MPH, Ilyssa E. Hollander, MPH

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Author Affiliations:
Youth Alcohol Center at Boston University School of Public Health (JH and NSB), Social Sectors Development Strategies, Incorporated, Natick, Massachusetts (NSB, IEH)

Corresponding Author: Dr. Jonathan Howland

Jonathan Howland, PhD, MPH
Department of Social and Behavioral Sciences
Boston University School of Public Health
715 Albany Street
Boston, MA 02118
Phone: 617 638 5158
Fax: 617 638 4483
jhowl@bu.edu

Work performed at:

US Army Research Institute of Environmental Medicine
Kansas St., Building 86
Natick, MA 01760-5007

and

Department of Social and Behavioral Sciences
Boston University School of Public Health
715 Albany Street
Boston, MA 02118

CAUSES AND NATURE OF INJURY AMONG ARMY SOLDIERS HOSPITALIZED WITH ALCOHOL COMORBIDITY

Authors: Jonathan Howland, PhD, MPH, Nicole S. Bell, ScD, MPH, Ilyssa E. Hollander, MPH

Abstract

Aim: To examine the relationship between alcohol use and risk for specific types and causes of injury.

Design/Setting: We used the Total Army Injury and Health Outcomes Database (TAIHOD) to conduct cross-sectional analyses of the association between alcohol comorbidity and the nature, cause, and severity of injury.

Participants: Subjects were active duty US Army soldiers (N=211,790) hospitalized with a primary diagnosis of injury between 1980 and 2002.

Findings: Alcohol comorbidity was positively associated with head injury, open wounds and poisonings and negatively associated with musculoskeletal injury; positively associated with fights and falls and negatively associated with sports injury; and, on average, associated with shorter length of stay. Controlling for demographic factors did not moderate the association between alcohol and nature, cause or severity of injury.

Conclusion: Injury nature, cause and severity covary with alcohol comorbidity.

Keywords: alcohol, injury type, injury cause, injury severity, military

INTRODUCTION

Acute alcohol exposure contributes to injury through impaired cognition, motor function, risk-taking judgment, or the combination of these effects. Chronic exposure may result in compromised cognitive function, depression or poor health, all of which may also lead to injury.

Few studies, however, have explored the extent to which alcohol is associated with specific types and causes of injury and these have yielded mixed results. In a recent study involving patients (≥ 15 years of age) presenting with injury at an emergency department (N=593), no relationship was found between drinking and injury type or cause (1). Cherpitel found no association between acute alcohol exposure and cause of injury in a probability sample (N=1,494) of adult patients presenting at four California hospitals (2). In a study of hospitalized trauma patients selected for multi-substance toxicological screening, Blondell et al. found no association between type of injury and alcohol, after controlling for cocaine exposure (3).

In contrast, when Savola et al. studied 385 consecutive admissions (>16-49 years of age) at a trauma center in Finland, alcohol dependency and binge drinking were significantly more frequent among patients with head trauma than those with other injury types, with the odds of head injury increasing with an increase in blood alcohol concentration (BAC) (4). In a sample of adolescents (N=8,885), Swahn et al. found that those who reported problem drinking were more likely to sustain violent injury, or cause violent injury, than drinking peers without alcohol problems (5). Variations in alcohol measurements, study populations, and type of injuries investigated make it difficult to draw conclusions from the literature about whether alcohol affects the nature or cause of injury.

Alcohol may also influence injury severity, but again, evidence is mixed. A few studies suggest a protective effect associated with alcohol. Albrecht-Anoschenko et al. studied 140

patients who had sustained head injuries after falling down stairs (6). Patients classified as intoxicated (≥ 0.08 g% BAC) at the time of the fall experienced lower mortality (12.9%) than the nonintoxicated group (33.3%), controlling for age, ($p=0.001$). In a study of young patients (12-25 years of age) treated in trauma centers, Porter found a significant downward trend in injury severity with increasing intoxication ($p<0.01$) (7).

In contrast, in a study of 14,995 males presenting at a Helsinki emergency room there were no differences in overall hospitalization rates for sober and intoxicated patients, but injuries resulting from car crashes and from falls down stairs were significantly more likely to result in hospitalization when alcohol was involved (8). Spaite et al. found that in adult (≥ 18 years of age) trauma center patients (N=350) presenting with bicycle-related injuries, alcohol exposure was highly associated with greater injury severity, longer hospitalization, and higher health care costs (9). Similarly, Garrison et al. found that among 362 male patients with spinal cord injuries, those with cervical injuries were twice as likely as those without cervical injury to have used alcohol when injured (10). More information is needed to better understand how alcohol may influence the nature, cause, and severity of injury.

Alcohol may differentially affect nature, cause and severity of injury in several ways. Alcohol may be directly associated with risk for certain types of injuries because cognition and motor functioning are more critical to safely perform some types of antecedent behaviors (driving vs. walking). Reflexive actions, such as putting out hands or twisting may be compromised by alcohol resulting in greater risk of head injury during a fall or other injuries. Alternatively, the relationship may be indirect. Propensity to use alcohol may covary with type of activity and thus type of injury. For example, alcohol is less likely to be consumed during sporting activities, which pose a risk for lower-extremity injuries (e.g., sprains, fractures), than

during recreational aquatic activities (e.g., swimming, boating), which pose a risk for drowning (11-14). Also, alcohol screening may be more frequent for some types of injury (e.g., head injury) for purely clinical reasons. Similarly, associations between injury and alcohol may result from variation in health care providers' tendencies to note alcohol exposure on medical records based on patient characteristics (sex, age, occupation), which in turn may be associated with injury type.

Alcohol may impact injury severity by impeding recovery, resulting in longer lengths of stay. For example, acute intoxication has been linked to poor outcomes among traumatic brain injury victims (15, 16). Alcohol may also impede recovery from injury types, such as poisoning, either through direct interaction with the poison agent or by covariance with mental health disorders, such as depression. Alcohol may also indirectly relate to other severity measures (i.e., length of stay) by its association with tobacco use, which has been linked to slower healing (17-19).

The aim of this study was to determine if alcohol comorbidity was associated with the nature, causes and severity of injury, controlling for demographic characteristics. To explore these relationships, we identified all hospitalizations for U.S. Army personnel (1980-2002) with an injury diagnosis and determined whether there was a secondary diagnosis for either acute or chronic alcohol exposure (alcohol comorbidity) in the record for initial or transferred treatment. Army soldiers are an important population for study because unintentional and intentional injuries are leading causes of morbidity and mortality for the armed forces.

METHODS

The Data

Data come from the Total Army Injury and Health Outcomes Database (TAIHOD) a relational database linking health and administrative records for active duty Army personnel (20, 21). Portions of the TAIHOD used for this study include hospitalization data from the Army Individual Patient Data System and personnel records from the Defense Manpower Data Center. Personnel data are updated biannually and include demographic characteristics, such as age, gender, race, military rank, and discharge information.

Active duty soldiers, whether hospitalized in civilian or military facilities, receive a primary diagnosis (International Classification of Diseases, 9th Revision, Clinical Modification [ICD-9-CM]) and up to 7 secondary diagnoses for a given hospitalization. Injuries also receive additional codes to indicate cause and place of injury using the NATO Standardized Agreement 2050 (STANAG). Unlike civilian cause coding (E-codes), the STANAG is very complete and uses two separate variables to capture information on both intent and proximal cause (trauma code and injury code, respectively) (22, 23).

Study Design

The initial study population comprised all active duty Army soldiers hospitalized one or more times with a primary diagnosis of injury (ICD-9-CM 800-995) between January 1, 1980 and December 31, 2002. Injuries related to legal intervention and combat, identified using the STANAG trauma code, were excluded because in these situations a soldier would likely have little control over alcohol availability and his/her injury risk exposures. We also excluded ICD-9-CM 980.0 (Ethyl Alcohol Poisoning) because of overlap with alcohol comorbidity. Other subcategories of 980 (Poisoning) including 980.1, 980.2, 980.3 and 980.4 were included.

When patients were admitted to one medical care facility and subsequently transferred to continue treatment of the initial injury, we considered the multiple hospitalizations as a single injury event. In a few cases, because of missing or incomplete transfer codes, it was unclear whether a series of two or more hospitalizations were transfers or separate injury events. To avoid over counting where soldiers had multiple qualifying injury hospitalization records occurring within a two-day period, the first hospitalization record was considered the initial visit and successive related records were considered transfers. Hospitalization records with complete transfer code data, and that occurred within 7 days of each other, were also coded as transfers.

Once transfer records were removed, some soldiers still had repeat injury events. When individuals had more than one qualifying injury event, one injury hospitalization was randomly selected for analysis. Since an individual could not contribute multiple observations to the data set, potential bias was reduced and correlated error terms in the multivariate models avoided.

Measures

Nature of Injury (Diagnoses): Injury type, or nature, was classified according to the primary ICD-9-CM diagnosis between 800–995 for any hospitalization. We conducted subanalyses of head injuries and lower-extremity musculoskeletal injuries because they were frequent among all injured patients and because of a priori hypotheses regarding the association between alcohol use and injury type. Head Injury included brain injury/concussion (codes 850 – 854) and skull fractures (codes 800-805). Lower-extremity musculoskeletal injury was defined by codes 820-829 (lower limb fractures), and 843-845 (lower limb strains and sprains).

Cause of Injury: Based upon a priori hypotheses, we defined six major causes of injury using the injury and trauma components of the STANAG: ingested poisoning (STANAG 700-709), excluding ethyl alcohol poisoning; sports (STANAG 200-239); driving personally owned motor

vehicle (POV) (STANAG 100 [includes all privately owned vehicle crashes where injured person was the driver]); driving any vehicle (STANAG 100 [passenger car driver], 105 [bicycle], 106 [motorcycle], 110 [military vehicle driver], 115 [military bicycle], 116 [military motorcycle]); falls (STANAG 900-929); and non-combat-related assault (STANAG injury codes: 970-979 [fighting], or STANAG trauma code = 3 [intentional] with and injury cause code = to 640-649, 560-569, 580-589, 590-599, or 980-989 [1]).

Secondary alcohol diagnosis: An injury hospitalization was considered to have alcohol comorbidity when: (1) an alcohol-related diagnostic code (see Table 2) appeared in a secondary diagnosis position of the hospitalization record; or, (2) an alcohol diagnosis appeared in any diagnostic position of the transfer hospital record.

Demographic Characteristics: Age groups were based upon prior work indicating a nonlinear association between age and alcohol consumption (<21, 21-25, 26-30, 31-35, 36-40 and >40) (24). Officers were combined for analysis due to small strata. We grouped enlisted soldiers according to seniority: junior (E1-E4), mid-level (E5-E6) and senior (E7-E9).

Length of Stay: Length of stay (LOS) was calculated using hospital admission and discharge date, and included both the initial and transfer hospitalizations where relevant.

Analyses

We analyzed, by alcohol comorbidity: (1) the 10 most common injury types, and (2) the causes that contributed ≥ 1% of all injury events. Logistic regression controlled for demographic characteristics and calculated risk estimates (odds ratios) associated with alcohol comorbidity for

[1] The assault definition was developed as part of another project focused on hospitalized assaults. The definition resulted from review of all STANAG cause/intent code and narrative text analyses.

selected types and causes of injuries. Mean LOS was compared by alcohol comorbidity and within specific injury causes and types.

Analyses were conducted in SAS, version 8.2 (25). All analyses adhered to policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46. This study was approved by the Human Studies Research Review Board of the US Army Medical Research and Material Command.

FINDINGS

Of the 1,942,308 hospitalizations between January 1, 1980 and December 31, 2002 documented in the TAIHOD, 11% (211,790) were for injuries. These included individuals who had one or more injury hospitalizations meeting inclusion criteria. Ninety percent of individuals with an injury hospitalization experienced only one injury hospitalization; 9% had two injury hospitalizations; and, 1% had > 2 injury hospitalizations. Three percent of hospitalizations involved a transfer.

Secondary Diagnosis for Alcohol

Table 1 arrays population characteristics by secondary alcohol diagnosis. Alcohol comorbidity was slightly, yet significantly, associated with sex of patient (4.5% of men vs. 3.8% of women; OR=1.18; 95% CI: 1.09-1.27). Younger age, lower education, separated or widowed marital status, lower rank, and white race were also significantly associated with alcohol comorbidity. Age was inversely associated with a significant, and linear, increased likelihood of alcohol involvement (Chi-Square for linear trend=19.31, p <.0001), except for the 21-25 year old group which was at greatest risk. Rank was highly correlated with alcohol comorbidity, with lowest ranking enlisted soldiers 8 times as likely as officers to have an alcohol diagnoses.

{INSERT TABLE 1 HERE}

Of 211,790 injury hospitalizations, 4% (9,093) had a secondary diagnosis for alcohol at the initial visit. Less than 1% (237) received alcohol-related diagnoses only when transferred. Enlisted personnel were significantly more likely than commissioned officers to receive an alcohol diagnosis at the initial visit as opposed to transfer (OR=6.40; 95% CI: 3.04-13.09) (data not shown). Conversely, injured commissioned officers were more likely than enlisted injured soldiers to have an alcohol diagnosis only in the transfer record and to have no alcohol diagnosis in the initial hospital record. Similarly, women were significantly more likely than men to have an alcohol diagnosis in the transfer visit only (OR=2.23; 95% CI: 1.52-3.27) (data not shown).

Table 2 shows results of logistic regression models assessing the contribution of patient characteristics to the likelihood of having alcohol comorbidity. Alcohol comorbidity was significantly associated with being male, unmarried, white, less educated, and of lower rank. In unadjusted models, younger age was positively associated with risk of alcohol involvement but once all variables were in the model, the association flipped and younger age was protective.

{INSERT TABLE 2 HERE}

Figure 1 compares the 10 most frequent types of injury by alcohol comorbidity. Injuries involving head trauma and poisonings were common to both lists, but about half of those with alcohol comorbidity had head injuries vs. a third of those without alcohol comorbidity; and, 17% of those with alcohol comorbidity had poisonings vs. 9% of those without. A third of those with alcohol comorbidity had open wounds to the head or wrist, whereas these types of injuries were not among the10 most frequent injury types for those without alcohol comorbidity. Over half of the 10 most frequent injury types among those without alcohol comorbidity were

musculoskeletal injuries, but these injuries were not among the most common injury types for those with alcohol comorbidity.

{INSERT FIGURE 1 HERE}

There were 43,766 head injuries and 168,024 injuries of other types. Controlling for demographic covariates, soldiers with alcohol comorbidity were significantly more likely to have head injury, and were significantly more likely to be male, younger, less educated, single, black and of lower rank (Table 3).

There were 48,282 lower-extremity musculoskeletal injuries and 163,508 other types of injuries. Controlling for demographics, soldiers with alcohol comorbidity were significantly less likely to have lower extremity musculoskeletal injuries. Significant risk factors for having lower-extremity musculoskeletal injuries included being male, older, better educated, married, and an officer (Table 3).

{INSERT TABLE 3 HERE}

Table 4 compares causes of injuries by alcohol comorbidity, adjusting for demographic characteristics. Alcohol comorbidity was associated with injuries resulting from ingesting poison, car crashes, falling, and fighting and/or assault. Those without alcohol comorbidity were more likely to have been injured while playing sports (Table 4).

There were 12,672 ingested poisoning injuries and 199,118 other types of injuries. In multivariate models, soldiers with poisoning injury were more than 5 times as likely to have alcohol comorbidity and were significantly more likely to be female, younger, less educated, married, and have lower rank (Table 4).

There were a total of 32,659 sports-related injuries. Controlling for demographics, soldiers with sports injuries were significantly less likely to have alcohol comorbidity, and

significantly more likely to be male, under the age of 41, better educated, of higher rank, married, and a minority (Table 4).

There were 11,003 injuries to drivers of POVs and 200,787 other injuries. Controlling for demographics, soldiers with POV-related injury were significantly more likely to have alcohol comorbidity and significantly more likely to be female, older (differences were only statistically significant for those age 31-40), less educated, and non-white (Table 4). There were 21,806 injuries to drivers of any type of vehicle. Alcohol comorbidity was significantly associated with vehicular injuries, but the odds were lower than for drivers of POV only. They were also significantly more likely to be male, younger, of higher rank, and white (Table 4).

There were 25,245 fall-related and 186,545 non-fall injuries. In multivariate models alcohol comorbidity was significantly associated with fall-related injuries, as were female gender, older age, lower rank, single marital status, and white race (Table 4).

There were 17,168 injuries resulting from fighting and/or assault. Controlling for demographics, soldiers with injuries resulting from non-combat fights/assaults were significantly more likely to have alcohol comorbidity and were more likely to be male, younger, less educated, single or no longer married, of lower rank, and black (Table 4).

{INSERT TABLE 4 HERE}

Length of Stay

The average LOS for all injuries was 12.8 days (S.D. 30.66). Those with alcohol comorbidity had significantly shorter LOS (8.5 days; S.D. 28.30) than those without alcohol comorbidity (13.0 days; S.D. 30.75). LOS varied by cause and type of injury and by alcohol comorbidity (Table 5). Among injuries with alcohol comorbidity, sports injuries were associated with longest LOS. Among those injuries that did not involve alcohol, the longest LOS was

associated with motor vehicle crashes. Head-injured patients with alcohol comorbidity had shorter LOS, but patients with lower-extremity musculoskeletal injuries and alcohol comorbidity had more than one week longer LOS than lower-extremity injuries without alcohol comorbidity (29.6 versus 20.5 days, respectively) (Table 5).

{INSERT TABLE 5 HERE}

DISCUSSION

Our findings indicate that injured hospitalized U.S. Army soldiers with alcohol comorbidity differed from their injured peers without alcohol comorbidity in their demographic characteristics, the types and causes of injury, and average LOS to treat their injuries. Alcohol comorbidity was associated with head injury, poisonings, and open wounds, whereas the absence of alcohol comorbidity was associated with lower extremity musculoskeletal injury. Alcohol comorbidity was associated with falls and fights, whereas the absence of comorbidity was associated with sports-related injuries. Average LOS was shorter for those with alcohol comorbidity, with the exception of those being treated for lower-extremity musculoskeletal injuries, which were often sports-related.

Alcohol was associated with falls, fights, and motorcycle, bicycle, and car crashes, all common causes of head injury. The association between alcohol comorbidity and head injury could have been an artifact of clinical protocols (e.g., toxicology screening when neurological damage is evident or suspected), but, is consistent with findings by other investigators (4). Our finding that alcohol diagnosis was associated with intentional injury (e.g. fights) was consistent with much of the literature on alcohol and violence (26, 27).

It is interesting that we found that LOS was shorter overall among patients with alcohol comorbidity. Porter and Honkanen and Smith found no association between alcohol exposure

and injury severity (7, 8). Our finding that head-injured patients with alcohol comorbidity had shorter LOS than head-injured patients without alcohol comorbidity is particularly curious. One possibility is that those with alcohol comorbidity were more seriously injured and therefore died more often than those without alcohol comorbidity. But Savola et al. found no association between severity of head trauma and positive blood alcohol levels (4). Another possibility is that those with alcohol comorbidity had less serious head injuries. Alcohol comorbidity was associated with risk for falls on the same level, which could yield less severe head injuries than those resulting from falls from heights. But, even when the cause of head injury is held constant, alcohol appears protective. Honkanen and Smith found that among emergency room patients presenting with head injuries due to falls from the same level, those intoxicated were significantly <u>less</u> likely than sober head/brain-injured patients to require hospitalization (OR = 0.16; 95% CI: 0.01-0.02) (8). Similarly, Albrecht-Anoschenko et al. found that among patients with head injury resulting from falls down stairs, mortality was less likely among intoxicated patients than among sober patients (6). Thus, the association of shorter LOS with alcohol comorbidity is open to speculation. Those intoxicated might be more relaxed during the injury event. Alternatively, they may get hurt during more minor aspects of an activity, before they can engage in more dangerous acts. Soldiers with alcohol problems may be less likely to remain on active duty and thus be transferred out of the Army to continue care. Once out of the Army, we would not be able to count any extra days spent caring for an injury.

Strengths and Limitations

This report adds to a small and relatively recent literature on the relationship of alcohol to the nature, cause, and severity of injury. Our findings are consistent with some previous studies, but differ from others. Apparent inconsistencies in findings could be due to variations in locale.

For example, alcohol may be a greater risk factor for level falls in Finland than in Australia because of climate (e.g., icy paths and roads). This might explain varied findings between Honkanen and Smith and Watt et al. (1, 8). Other factors, such as local laws on seat belt use, drunken driving, or alcohol availability might interact with drinking to modify risks for specific types and causes of injury.

Our study addressed several potential confounding factors. First, though demographic characteristics influence both alcohol use and the propensity to engage in specific activities, with varying levels of injury risk, multivariate analyses indicate an independent relationship between alcohol comorbidity and the nature and cause of injury. Second, provider reluctance to screen for or document alcohol exposure in women and officers could lead to misattribution, such that the strength of the alcohol association would be reduced for their injuries. However, we were assiduous in capturing and linking transfer medical records to mitigate potential provider history-taking bias during initial emergency room screening and care for the injury.

Because we use archival data and a cross-sectional design, there are potential weaknesses to our study that could affect interpretability. First, our analyses could not distinguish between chronic and acute alcohol exposure. The diagnosis of alcohol comorbidity could indicate that the presenting patient evidenced: (1) acute alcohol exposure with history of drinking problems; (2) acute alcohol exposure, without history of drinking problems; or (3) no acute exposure to alcohol, but a history of drinking problems. Accordingly, the extent to which alcohol played a direct causal role in injuries is tempered by the fact that some individuals with alcohol comorbidity may have been sober at the time of the injury event. Nonetheless, we assume that most of the time, alcohol comorbidity signifies evidence of acute exposure. Moreover, the

imprecision of the alcohol comorbidity diagnosis would weaken the relationship between alcohol and the outcomes we studied. Our findings were robust.

Major study strengths are that it uses a very large data set, drawn from a diverse population, treated in many locales, and, encompassing the entire active duty Army population over a 20-year time span. Active duty service members have total healthcare coverage permitting virtually total capture of all hospitalization records. There is relatively little missing information on demographic characteristics. The ability to identify and link hospitalizations allows us to distinguish between repeat injury events and transfers to continue care for the same injury event. This is an important strength of this database and prevents over counting events. Finally, the military STANAG cause coding system provides much more detailed and complete cause-of-injury data than that currently available in most civilian electronic hospital databases.

CONCLUSIONS

We conclude that our study provides substantial support to the hypothesis that alcohol poses risks for specific types and causes of injury.

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Tables and Figures

Table 1. Demographic characteristics of Army soldiers hospitalized for injury, 1980-2002, stratified by presence of secondary alcohol diagnosis: Unadjusted odds of alcohol comorbidity.

Characteristics	Secondary Alcohol Diagnosis		OR	95% CI
	Yes	No		
Gender[a]				
Male (N = 193,660)	4.5%	95.5%	1.18	1.1-1.3
Female (N =18,036)	3.8%	96.2%	1.00	
Age[b]				
<21 (N = 62,486)	4.6	95.4%	1.81	1.5-2.2
21-25 (N = 83,336)	4.9%	95.1%	1.96	1.6-2.4
26-30 (N = 33,801)	3.8%	96.2%	1.50	1.2-1.8
31-35 (N = 17,891)	3.4%	96.6%	1.30	1.1-1.6
36-40 (N = 9,358)	3.1%	96.9%	1.20	1.0-1.5
41+ (N = 4,443)	2.6%	97.4%	1.00	
Education[c]				
< HS (N = 17,947)	6.0%	94%	3.37	3.01-3.76
HS (N = 166,306)	4.6%	95.6%	2.57	2.34-2.83
Some College or greater (N =25,332)	1.9%	98.1%	1.00	
Marital Status[d]				
Married (N = 84,664)	3.7%	96.3%	1.00	
Single (N = 120,484)	4.9%	95.1%	1.34	1.28 – 1.40
Separated, Divorced or Widowed (N = 4,062)	5.5%	94.5%	1.52	1.32-1.75
Rank[e]				
Junior Enlisted, E1-E4 (N= 146,216)	5.1%	94.9%	8.86	6.98-11.27
Middle Enlisted , E5-E6 (N =42,353)	3.5%	96.5%	6.02	4.72-7.69
Senior Enlisted, E7-E9 (N = 9404)	2.8%	97.2%	4.71	3.60-6.18
Warrant (N = 1,888)	1.2%	98.8%	1.94	1.16-3.12
Officer (N = 11,912)	0.6%	99.4%	1.00	
Race[f]				
White (N =142,881)	4.8%	95.2%	1.45	1.37–1.53
Black (N = 51,)194)	3.3%	96.7%	1.0	
Hispanic (N = 8,729)	4.5%	95.5%	1.38	1.23 – 1.55
Other (N = 8,724)	4.8%	95.2%	1.47	1.32 –1.64

[a] 94 missing information on gender
[b] 475 missing information on age
[c] 2,205 missing information on education
[d] 2,580 missing information on marital status
[e] 39 missing information on rank
[f] 262 missing information on race

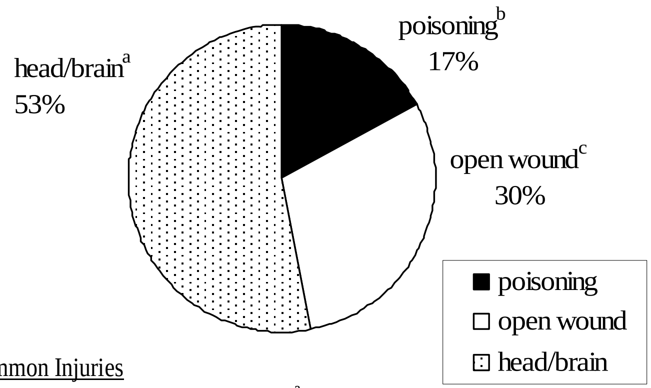
Table 2. Demographic risk factors for alcohol comorbidity among Army soldiers hospitalized for injury, 1980-2002: Results from multivariate logistic regression analysis.

Characteristics	OR	95% CI
Gender [a]		
Male	1.13	1.04-1.22
Female	1.00	----------
Age [b]		
<21	0.44	0.35-0.55
21-25	0.58	0.51-0.78
26-30	0.63	0.51-0.78
31-35	0.73	0.58-0.90
36-40	0.85	0.68-1.10
41+	1.00	----------
Education [c]		
< HS	1.98	1.75-2.25
HS	1.57	1.41-1.74
Some College or greater	1.00	----------
Marital Status [d]		
Married	1.00	----------
Single	1.17	1.11-1.23
Separated, Divorced or Widowed	1.49	1.29-1.71
Rank [e]		
Junior Enlisted, E1-E4	7.66	5.85-10.03
Middle Enlisted , E5-E6	4.86	3.71-6.37
Senior Enlisted, E7-E9	3.16	2.37-4.23
Warrant	1.70	1.01-2.84
Officer	1.00	----------
Race [f]		
White	1.51	1.43-1.59
Black	1.00	----------
Hispanic	1.40	1.25-1.57
Other	1.47	1.31-1.64

[a] 94 missing information on gender
[b] 475 missing information on age
[c] 2,205 missing information on education
[d] 2,580 missing information on marital status
[e] 39 missing information on rank
[f] 262 missing information on race

Figure 1. The Ten Leading Types of Injury Diagnosis for those with and without Alcohol Comorbidity

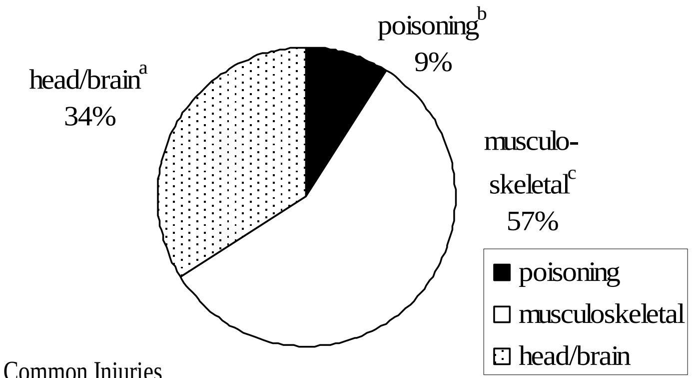
With Alcohol Comorbidity



10 Most Common Injuries

1. Brain injury NOS w/o open wound (8540) [a]
2. Open wound of wrist (88102) [b]
3. Poisoning by aromatic analgesics NEC (9654) [c]
4. Concussions w/o coma (8500) [a]
5. Brain injury NOS w/o open wound-unspecified coma state (85400) [a]
6. Open wound of scalp w/o complication (8730) [b]
7. Poisoning by antirheumatics (9656) [c]
8. Open wound of face w/o complication (8734) [b]
9. Brain injury NOS w/o open wound-coma unspecified duration (85406) [a]
10. Brain injury NOS w/o open wound-brief coma (85402) [a]

Without Alcohol Comorbidity



10 Most Common Injuries

1. Ankle fracture NOS-closed (8248) [b]
2. Brain injury NOS w/o open wound-unspecified coma state (85400) [a]
3. Lumbar vertebra fracture-closed (8054) [b]
4. Brain injury NOS w/o open wound (8540) [a]
5. Poisoning by aromatic analgesics NEC (9654) [c]
6. Knee dislocation, tear medial cartilage/menisci-current (8360) [b]
7. Mandible Fracture-closed (8022) [b]
8. Concussion w/o coma (8500) [a]
9. Sprain, cruciate ligament of knee (8442) [b]
10. Dorsal vertebra fracture-closed (8052) [b]

Table 3. Alcohol and Nature of Injury – Variation in role of alcohol as comorbidity for different types of injury: The odds of alcohol comorbidity among soldiers with head injury versus other injury and for lower-extremity injuries versus other injuries controlling for demographic characteristics, all Army injury hospitalizations 1980-2002.

Characteristics	**Head Injury**		**Lower-Extremity Injury**	
	OR	95% CI	OR	95% CI
Alcohol comorbidity				
Yes	1.70	1.53-1.78	0.18	0.16-0.20
No	1.00	-----------	1.00	---------
Gender				
Male	1.32	1.26-1.38	1.37	1.32-1.43
Female	1.00	-----------	1.00	----------
Age				
<21	1.45	1.31-1.61	0.69	0.64-0.75
21-25	1.47	1.33-1.63	0.84	0.78-0.91
26-30	1.27	1.15-1.40	0.99	0.92-1.06
31-35	1.08	0.98-1.20	1.07	0.99-1.15
36-40	0.99	0.89-1.11	1.06	0.98-1.15
41+	1.00	----------	1.00	----------
Education				
< HS	1.09	1.03-1.15	0.77	0.73-0.82
HS	0.96	0.91-1.00	0.96	0.92-1.00
Some College or greater	1.00	----------	1.00	----------
Marital Status				
Married	1.00	----------	1.00	----------
Single	1.24	1.21-1.28	1.06	1.04-1.09
Separated, Divorced or Widowed	1.14	1.05-1.24	1.04	0.96-1.12
Rank				
Junior Enlisted, E1-E4	1.24	1.15-1.33	0.59	0.56-0.63
Middle Enlisted , E5-E6	1.19	1.11-1.28	0.70	0.66-0.74
Senior Enlisted, E7-E9	1.07	0.98-1.17	0.82	0.76-0.88
Warrant	1.21	1.04-1.41	0.82	0.76-0.88
Officer	1.00	----------	1.00	----------
Race				
White	1.14	1.11-1.17	0.96	0.93-0.98
Black	1.00	----------	1.00	----------
Hispanic	1.13	1.07-1.21	0.97	0.92-1.02
Other	1.08	1.02-1.15	0.96	0.90-1.01

Table 4. Alcohol and cause of injury – Variation in role of alcohol as comorbidity for different causes of injury: The odds of alcohol comorbidity for selected causes of injury controlling for demographic characteristics, all Army injury hospitalizations 1980-2002.

Characteristic	**Poison OR (95% CI)**	**Sports OR (95% CI)**	**Driver Private Vehicle OR (95% CI)**	**Driver all Vehicle OR (95% CI)**	**Falls OR (95% CI)**	**Fighting/ Assault OR (95% CI)**
Alcohol Comorbidity						
Yes	5.37 (5.08-5.67)	0.04 (0.04-0.06)	2.16 (2.01-2.32)	1.42 (1.33-1.51)	1.13 (1.06-1.20)	2.58 (2.44-2.73)
No	1.00	1.00	1.00	1.00	1.00	1.00
Gender						
Male	0.22 (0.21-0.23)	2.09 (1.98-2.20)	0.92 (0.86-0.99)	1.28 (1.21-1.36)	0.74 (0.71-0.78)	2.38 (2.20-2.58)
Female	1.00	1.00	1.00	1.00	1.00	1.00
Age						
<21	1.93 (1.53-2.44)	1.20 (1.09-1.33)	0.93 (0.79-1.09)	1.14 (1.00-1.28)	0.44 (0.39-0.48)	1.52 (1.20-1.94)
21-25	1.18 (0.94-1.49)	1.50 (1.37-1.65)	1.06 (0.91-1.24)	1.29 (1.15-1.45)	0.41 (0.37-0.45)	1.72 (1.35-2.18)
26-30	1.07 (0.85-1.34)	1.54 (1.41-1.69)	0.88 0.76-1.02)	1.12 (1.00-1.26)	0.48 (0.44-0.53)	1.53 (1.21-1.94)
31-35	1.08 (0.86-1.36)	1.50 (1.37-1.64)	0.85 (0.74-0.99)	1.02 (0.91-1.15)	0.56 (0.51-0.62)	1.31 (1.04-1.67)
36-40	1.13 (0.89-1.44)	1.30 (1.19-1.43)	0.83 (0.71-0.97)	1.02 (0.90-1.15)	0.65 (0.58-0.71)	1.33 (1.04-1.70)
41+	1.00	1.00	1.00	1.00	1.00	1.00
Education						
< HS	1.52 (1.36-1.69)	0.55 (0.51-0.59)	0.94 (0.84-1.06)	1.08 (1.00-1.17)	1.01 (0.94-1.09)	1.95 (1.78-2.14)
HS	1.14 (1.05-1.25)	0.82 (0.78-0.86)	1.12 (1.03-1.21)	1.10 (1.03-1.17)	0.95 (0.90-1.01)	1.26 (1.16-1.37)

Some College or greater	1.00	1.00	1.00	1.00	1.00	1.00
Marital Status						
Married	1.00	1.00	1.00	1.00	1.00	1.00
Single	0.68 (0.65-0.72)	0.93 (0.90-0.96)	0.95 (0.90-1.00)	1.04 (1.00-1.08)	1.14 (1.10-1.17)	1.36 (1.31-1.42)
Separated, Divorced or Widowed	0.83 (0.72-0.96)	1.04 (0.96-1.14)	1.11 (0.97-1.27)	1.09 (0.98-1.20)	1.06 (0.96-1.17)	1.33 (1.16-1.52)
Rank						
Junior Enlisted, E1-E4	4.02 (3.32-4.89)	0.44 (0.41-0.47)	0.88 (0.78-1.00)	0.97 (0.88-1.06)	1.66 (1.52-1.81)	4.39 (3.65-5.28)
Middle Enlisted, E5-E6	2.31 (1.90-2.80)	0.55 (0.52-0.58)	1.13 (1.00-1.28)	1.37 (1.25-1.50)	1.31 (1.20-1.43)	2.96 (2.46-3.57)
Senior Enlisted, E7-E9	2.00 (1.60-2.51)	0.61 (0.56-0.66)	1.12 (0.97-1.30)	1.37 (1.23-1.53)	1.23 (1.12-1.36)	2.06 (1.66-2.57)
Warrant	1.05 (0.65-1.71)	0.66 (0.58-0.75)	0.87 (0.66-1.15)	1.26 (1.05-1.51)	1.15 (0.97-1.36)	1.11 (0.71-1.75)
Officer	1.00	1.00	1.00	1.00	1.00	1.00
Race						
White	1.00	1.00	1.00	1.00	1.00	1.00
Black	0.99 (0.95-1.04)	1.90 (1.85-1.96)	1.33 (1.27-1.39)	0.80 (0.77-0.82)	0.68 (0.66-0.70)	1.19 (1.14-1.23)
Hispanic	0.99 (0.90-1.09)	1.08 (1.02-1.15)	1.24 (1.13-1.37)	0.87 (0.81-0.94)	0.95 (0.89-1.02)	1.07 (0.99-1.16)
Other	0.95 (0.86-1.05)	1.07 (1.00-1.14)	1.01 (0.97-1.27)	0.82 (0.76-0.88)	0.93 (0.87-0.99)	1.13 (1.04-1.22)

Table 5. Length of stay by cause and major type of injury for those with and without secondary alcohol diagnoses. Army soldiers hospitalized for injury, 1980-2002.

	Secondary Alcohol Diagnosis		**No Secondary Alcohol Diagnosis**	
INJURY CATEGORY	**Mean Days**	**Total Days**	**Mean Days**	**Total Days**
All Causes & Types	8.5	79,257	13.0	2,635,460
Poison Ingestion	7.6	15,808	5.96	63,162
Sports	21.0	1,470	12.7	412,526
Driver of Personally Owned Vehicle	10.2	9,429	18.0	181,671
Driver of Any Vehicle	11.1	14,388	20.0	405,090
Falls	10.3	13,031	14.1	339,065
Fighting/Assault	4.9	8,678	12.7	195,413
Head Injury	9.1	26,368	15.3	623,980
Lower Extremity Injury	29.6	13,831	20.5	981,452

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Number of References: 52

Alcohol abuse history, health behaviors and psychosocial risk factors for assault-related hospitalization among active duty Army soldiers

Nicole S. Bell, ScD, MPH[1], Ilyssa Hollander, MPH[1], Paul J. Amoroso, MD, MPH[2]

[1] Social Sectors Development Strategies, Inc., Tacoma, WA and Boston, MA
[2] Department of Clinical Investigation, Madigan Army Medical Center, Fort Lewis, WA

Corresponding Author:

Dr. Nicole Bell. SSDS, Inc. 2330 South 3rd St. Tacoma, WA 98433. Voice/Fax: 253-399-2828. Cell: 253-279-4222. nbell@ssds.net

Address for Reprints:

Ms. Ilyssa Hollander. SSDS, Inc. 1411 Washington Street. Suite 6. Boston, MA 02118. 508- 233-4222 ihollander@ssds.net

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Abstract

Objective: Assess the association between drinking and other health and social behaviors and risk for assault-related hospitalization.

Design: Cohort

Setting: Active duty Army soldiers who completed an Army Health Risk Appraisal survey between January 1, 1990 and December 31, 2001.

Participants: 423,681 active duty Army soldiers followed through December 31, 2002

Main Outcome Measure: assault-related hospitalization

Results: 807 soldiers were hospitalized at least once for assault during the follow-up period. In multivariable Cox proportional hazards models male gender (3.45, 2.19-5.43), age under 31 (3.98, 2.71-5.85), black race versus white (1.65, 1.35-2.01), single marital status (1.69, 1.38-2.07), drinking 7 or more drinks per week versus abstaining (7-14 drinks =1.87, 1.42-2.47, >14 drinks = 1.68, 1.18-2.39), driving or riding in the past month with someone who had been drinking (1.39, 1.10-1.75), current smoking versus never (1.26, 1.03-1.54), and wearing a safetybelt less than 100% of the time (51-99% = 1.43, 1.16-1.76, 0-50% = 1.92, 1.52-2.43) were significantly associated with risk for assault. Symptoms of alcohol dependence (CAGE) and depression as well as other psychosocial factors were not. There was some evidence of a possible gender interaction suggesting safetybelt usage, and possibly psychosocial factors such as worries in the past year and job satisfaction, may be more important predictors of assault among women than men.

Conclusion: Heavy drinking, but not symptoms of alcohol dependence, is associated with risk for future assaults. Future research should test the safetybelt use, smoking

and violence association and hypothesized link to self-esteem as latent factor predicting assault.

Keywords:

Injury, Alcohol Drinking, Military Hospitals, Army soldiers, assault, violence

Introduction

Background

In 2004 there were 4,114,620 assault-related incidents to people age 12 or older reported in the National Crime Victimization Survey [1]. While not all assaults result in serious injury, a sizable portion does. In 2000 approximately 1.6 million persons were treated in hospital emergency departments for nonfatal physical (non-sexual) assaults, and 91,000 were hospitalized in the U.S. [2]. National Hospital Discharge Survey data suggest that in 2001 about 4% of injury hospitalizations resulted from assaults [3].

In 2004, nearly 4% of injury hospitalizations among armed forces personnel were caused by non-battle intentional injuries, including assault 4. Because these numbers reflect more serious injuries, the incidence of assault is likely much higher. More information is needed on factors associated with preventable injuries, such as assaults, in order to reduce human suffering and minimize the negative impact of assaults on individuals and communities, as well as on military readiness.

Demographic risk factors for assault include male gender (the rate in 2004 for men was 22.1/1000 and for women 15.1/1000 [1]), young age, black race, and single marital status. While being male is a risk factor, studies suggest that fighting among girls is increasing [5, 6]. Adolescents age 12-15 had the highest rate of assault (43.6/1000) followed by 16-19 year olds (38.6/1000), 20-24 year olds (37.4/1000), and 25-34 year olds (20.6/1000). There may be gender and age interaction such that the

youngest male age groups are at greatest risk while for females the greatest risk groups are those ages 20-24, followed by 16-19 and then ages 12-15. Rates of victimization were slightly higher for blacks than for whites for both genders, and were generally lower for Hispanic men and women. Single marital status was also a strong risk factor for assault. Nearly half of assault incidents (46.8%) involved strangers with the slight majority involving nonstrangers [1]. The most serious outcome of assault-related violence is homicide. In 2002 homicide was the twentieth most common cause of death overall but the sixth most common cause of death among African Americans [7]. Homicide is the fourth leading cause of death among 15-24 year olds and the fifth leading cause of death among 25-34 year olds [8].

Several studies have identified an association between acute intoxication and/or alcohol abuse and violence [9-15]. Acute intoxication may weaken normal cognitive restraints which can have a disinhibitory effect on impulsive behaviors [16-21]. Expectations about how alcohol will affect one's behavior may also influence behavior [16, 19, 22]. In addition, those with impulsive personalities are less likely to be deterred by negative alcohol expectancies [23]. Acute intoxication can impair motor or social judgment skills and individuals who have been drinking may miss social cues regarding appropriate behavior or may engage in more risk-taking activities [17, 20, 21]. Moreover, associations between alcohol consumption patterns and assault may reflect greater exposures to situations in which an individual might become the victim of violence (e.g., more likely to be in a bar with violent patrons [24]).

Chronic alcohol abuse may also compromise brain functioning and judgment, leading to violent behavior. Alcohol abuse and dependence are associated with depression and poor health outcomes which can lead to both victimization and perpetration of violence. A history of drinking may increase risk for assault victimization [25, 26]. Furthermore, Vinson (2003) found alcohol dependence to be associated with risk of intentional injury although the association was not as strong as the relationship between assault and acute intoxication [10].

The association between alcohol and assault may be indirect. Some researchers have shown that the same personality characteristics that lead people to drink (i.e. social anxiety, risk-taking) may lead to aggressive or violent behavior [16, 17, 19]. Individuals who are more likely to engage in violent behaviors are possibly more likely to consume alcohol. Fighting in adolescence is correlated with other risky behaviors including more sexual partners, tobacco use, and alcohol use [27]. More concerning, is the link between alcohol, fighting and the likelihood of carrying a gun or other weapon indicating that assault involving alcohol may be more likely to involve deadly weapons[28].

Certain psychosocial factors may predispose some individuals to experiencing violence, such as occupational or life stress. Unemployment [29], lower education [30], lower income [31] and lower literacy levels [32] have all been associated with experiencing assault-related violence. Low self esteem has been associated with increased risk of violence victimization for males [33] and greater exposure to dangerous situations [34], while depression has been linked to assault victimization among women [35]. Reduced

life satisfaction was also associated with increased physical fighting and being injured among adolescents [36].

Risk-taking personality traits may be associated directly with violence or with underlying factors such as impulsivity and drinking patterns. Speeding has been linked to both risk of trauma [37] and alcohol use [38], and smoking has been independently associated with violence [39, 40 41]. Liang et al. (1999) found seatbelt non-use to be clustered with drinking among young men and found associations between drinking and driving among females, while Hunter et al. (2000) found lowered seat belt use to be a risk factor for frequent alcohol intoxication among Air Force recruits [42].

Goals of this Investigation

This study prospectively assesses risk for serious assault by following 423,681 soldiers who report varying levels of alcohol use or abuse risk patterns and other psychosocial risk factors for up to eleven years while controlling for potential confounders or mediators of the alcohol-assault relationship. The goal of this study is to clarify the relationship between different patterns of alcohol consumption and abuse, alcohol dependence symptoms, as well as other health and psychosocial factors, and risk for subsequent serious assault-related injuries. Ultimately, this information may be useful to clinicians and interventionists to improve screening and better target interventions to prevent violence.

Methods

Study Design

Using a cohort analytic study design all active-duty Army soldiers who completed at least one health risk behavior survey between January 1, 1990 and December 31, 2001 were followed from survey completion date until they experienced an assault-related hospitalization, or until December 31, 2002, or until they left active duty (were censored).

The Total Army Injury and Outcomes Database (TAIHOD) was used to assess the relationship between self-reported drinking and other behaviors and subsequent risk for an assault-related injury hospitalization [43, 44]. The TAIHOD is a relational database that links health behaviors, demographics, occupational information and health outcomes for all active-duty Army personnel. Portions of the TAIHOD used for this study include the Army Health Risk Appraisal (HRA) surveys, personnel records (demographic and Army discharge data) from the Defense Manpower Data Center (DMDC), and inpatient hospitalization data from the Patient Administration Systems and Biostatistics Activity (PASBA).

Selection of Participants

The HRA was routinely offered to Army soldiers throughout the 1990s. While HRA surveys were not offered to a randomly selected sample of Army soldiers, the demographic composition of survey takers is very similar to nonsurvey takers [45]. The HRA survey includes 8 items querying respondents about their alcohol use history and behaviors including typical weekly drinking quantities, driving while intoxicated or riding

with an intoxicated driver within the prior month, and responses to the 4-item CAGE—an alcohol dependence screening tool [46]. In addition to the CAGE, respondents also answer two other items that are similar to the CAGE items, asking the respondents if they have ever had a drinking problem and if their friends were worried about their drinking. Studies suggest that the four CAGE items and the related two items show strong predictive validity and good internal consistency. Evaluation of all HRA alcohol items suggest good reliability and validity [45, 47, 48].

Self-reported alcohol use: The extended CAGE (CAGE2), which included the standard 4-items of the CAGE plus 2 additional questions, was used to classify alcohol dependence (yes to 2 or more of 6 alcohol problem items) from the HRA survey. Alcohol consumption measures (according to number of drinks per week) were also obtained from the HRA survey. Health and behavioral information (smoking, job satisfaction, anxiety and depression) was extracted from the HRA. Drinking and driving, seatbelt usage and speeding were also studied as proxies for risk-taking behavior and other underlying personality traits that may also predispose the individual towards violence.

Methods and Measurements

In addition to HRA data used to characterize risk exposures and to identify the cohort, occupational and demographic data in the TAIHOD were also used. Personnel files on all active duty soldiers and are updated every six months. Demographic data in

these files include characteristics such as gender, age, race/ethnicity, marital status, education and military rank. The personnel file closest to the HRA survey date was used.

Age was dichotomized (≤30 and >30) for analysis due to sparse cells in the upper age range. Soldiers were categorized by race/ethnicity into black, white, Hispanic or other. Education was categorized according to degree attained (≤ high school, some college and ≥ college). Rank denotes enlisted personnel, warrant officers or commissioned officers. Other variables studied include gender, marital status and number of claimed dependents.

Outcome Measures

Hospital records for active-duty soldiers are created in the PASBA hospitalization files when they are treated in either military or civilian facilities. They receive a primary diagnosis and up to 7 secondary diagnoses for a given hospitalization. Diagnoses are recorded according to the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM). Injury diagnoses receive additional codes that indicate cause and place of occurrence using the NATO Standardized Agreement 2050 (referred to as the STANAG) [49, 50]. Unlike civilian cause coding (E-codes), the STANAG tends to be very complete and uses two separate variables, the "trauma" and the "injury" codes, to capture information on both intent and proximal cause.

Hospital assaults are defined using STANAG codes. For this analysis, soldiers with a STANAG Trauma code 3 (intentional, inflicted by others) were included. We also included those with an Injury code of 97* (fighting) so long as Trauma code is not equal to 0, 1, 2, or 4. Battle-related trauma (Trauma = 0, 1), trauma resulting from legal intervention (Trauma = 2), and self-inflicted trauma (Trauma = 4) were excluded. Only the first assault-related hospitalization for a soldier following an HRA survey was analyzed.

Secondary ICD-9-CM diagnoses (diagnostic codes 2-8) were used to identify injury hospitalizations where an alcohol diagnosis was also recorded. A list of alcohol-related diagnosis was used to create a Yes/No alcohol flag variable (complete list available from authors upon request).

<u>Primary Data Analysis</u>

A Cox proportional hazard model was fit to the entire population. Because relatively few women contributed to the assault cases, gender specific models were constructed in order to better identify risks unique to women. Hazard functions were visually inspected to confirm assumption of proportional hazards. In a second series of analyses, hospital assault cases were flagged if there was a secondary alcohol diagnosis either in the initial assault hospitalization or in a related hospital transfer record. Univariate chi-square analysis followed by multivariable logistic regression analysis were used to explore associations with alcohol (versus no alcohol) assault hospitalizations. Analyses were conducted in SAS, version 8.2 (2001). All analyses

adhered to policies for the protection of human subjects as prescribed in Army Regulation 70-25, and the provisions of 45 CFR 46. This study was approved by the Human Studies Research Review Board of the US Army Medical Research and Material Command.

Results

There were 423,681 soldiers who completed an HRA during the study period and were followed for up to twelve years to assess risk for assault-related hospitalization. 807 of these soldiers were hospitalized subsequent to completion of the HRA at least once for an assault-related injury, between 1990 and 2002. Median length of follow-up time for the study population was 526 days (1.4 years) from time of survey administration.

Forty-five percent of the study population were abstainers, and just over five percent reported drinking more than two drinks a day on average during a typical week. 32,338 (14%) of the population responded affirmatively to CAGE2 and 11% (n = 43,999) said they drove after consuming too much alcohol or rode with an intoxicated driver at least once in the past month.

Table 1 shows the distribution of demographic characteristics and self-reported health and social behaviors by assault hospitalization status in unadjusted (univariate) Cox proportional hazard models. Demographic risk factors for assault include being male (there were only 45 female assault victims out of 57,940 total females in the study

group), young (<30 at greater risk), black, single, of enlisted rank and having a high school education or less. All health behaviors were associated with increased risk for assault victimization in the direction hypothesized. Assault risk increased linearly with increasing weekly alcohol consumption, and affirmative responses to the CAGE2. Soldiers who reported speeding were at greater risk for assault and this risk increased linearly with the self-reported amount of typical speeding over the limit. Seatbelt utilization was inversely and linearly related to increased risk for assault as well. Current smoking (but not former smoking) was also associated with increased assault risk. Psychosocial factors associated with assaults in unadjusted models include lower job satisfaction, self-reported worries in the past year that interfered with daily life, and self-reported depression in the past year.

{INSERT TABLE 1 ABOUT HERE}

In the multivariate Cox model, gender, age, race and marital status remained significant risk factors (Table 2). Rank and education dropped out of the model, but the direction of the associations remained the same as was observed in the unadjusted models. Light drinkers were not at significantly greater risk for assault but moderate and heavy drinkers were at significantly greater risk for subsequent assault related hospitalizations, as compared to alcohol abstainers. Similarly, those who reported at least one exposure to drinking and driving in the past month were also at significantly greater risk for assault.

Surprisingly, those who reported symptoms of alcohol dependence or alcohol problems were at lower risk for subsequent assault hospitalization, though the

association did not achieve statistical significance (Table 2). Current smokers were at significantly greater risk for subsequent assault. Failure to wear a seatbelt was associated with an increased risk for assault but speeding was not. None of the psychosocial factors were significantly associated with assault in the multivariate model, though low job satisfaction and worries in the past year did trend in the same directions observed in the univariate models. Finally, hypothesized interactions between gender and weekly drinking and gender and seatbelt use were not statistically significant and thus were not retained in the model.

{INSERT TABLE 2 ABOUT HERE}

Because there were so many men in the population, with the potential to overshadow any gender differences in risk factors, we constructed a gender-differentiated model (Table 3). While there were too few females to completely evaluate all risk factors, there were some notable differences in patterns of risk. For women, only weekly alcohol consumption and low seatbelt usage were statistically significant predictors of assault. Women who reportedly used their seatbelts 50% of the time or less were at nearly 5 times the risk for assault than those who reportedly wore seatbelts all the time. While men in the 0-50% seatbelt use group were also at increased risk, the effect size (HR = 1.85) was much smaller. Also of interest were the psychosocial factors. Worries and job satisfaction did not achieve statistical significance for women or men. But, the patterns of association appeared to be quite different with large and increasing HR for women with successively worse psychosocial problems, but no obvious trend, for men.

{INSERT TABLE 3 ABOUT HERE}

Only eleven percent (n = 91) of the hospital assaults had a secondary diagnosis of alcohol in the assault record or in a related hospital transfer record. Assault hospitalizations with a secondary alcohol diagnosis were more likely than those without to involve brain-related trauma with or without coma. In 36% of assault cases with alcohol comorbidity the primary injury diagnosis was a brain-related injury compared to 13% of assaults without alcohol comorbidity (data not shown).

In unadjusted chi-square analyses only male gender, heavy weekly drinking and smoking were significantly associated with whether or not the assault involved alcohol. Job satisfaction and speeding also bordered on significance, though the direction of the association for speeding suggested it was protective. Increasing levels of driving over the speed limit were associated with lower risk of alcohol-involvement in the assault (data not shown).

Though strongly predictive of assault per se, seatbelt use was not associated with alcohol involvement during the assault event ($p = 0.72$). Education ($p = 0.73$) and depression ($p = 0.95$) were also not related to alcohol comorbidity. These three variables were dropped from the multivariate model while all other variables were initially retained. In reverse step-wise multivariable logistic regression models with p for exclusion set at 0.20, only weekly drinking and speeding remained in the final model predicting alcohol comorbidity. As with the unadjusted findings, speeding was associated with alcohol comorbidity among those hospitalized for assault-related injury

but, again, was protective. While the odds ratio (OR) for speeding was sufficient to remain in the overall model ($p < .20$) the variable did not achieve statistical significance at the traditional $p=.05$ level. Only heavy drinking, measured prior to and independent of the assault hospitalization event, was predictive of alcohol comorbidity for assault cases (OR for 15+ drinks versus no alcohol = 4.39, 95% CI = 1.72 – 10.9). Because of small cells these findings should be interpreted with caution (data not shown).

Limitations

While the overall study population was large, the proportion of female assault cases was relatively small which limited our power to test some of the hypothesized risk factors of interest. Lack of a direct measure of self-esteem and other latent factors limit our ability to test hypotheses generated through exploration of existing data. Future research should remedy these weaknesses by oversampling women and more directly assessing psycho-social factors such as self-esteem.

Discussion

This study identifies several factors which may serve as early warnings of interpersonal problems that could lead to violence. Factors associated with a subsequent assault-related injury hospitalization include male gender, young age, black race, single marital status, moderate and heavy weekly drinking, drinking and driving, smoking and failing to wear a safety belt. Surprisingly, measures of alcohol problems and potential dependence (CAGE2) were not associated with assault. This suggests that behaviors that tend to covary with heavy drinking, such as impulsivity and aggression but which are less commonly associated with alcohol dependence may be

more important than alcohol use per se in predicting violence. White and Chen (2002) support this claim by suggesting that chronic heavy drinking may sedate individuals resulting in decreased ability to act on aggressive urges [51].

While speeding and not wearing a seatbelt are both important behaviors to target for prevention of motor vehicle-related injuries, they do not appear to represent similar personality traits, at least regarding their association with violence. Speeding was not associated with increased risk for assault victimization, but seatbelt usage was. In fact, speeding, or the underlying personality construct it represents, may be protective against alcohol-related violence. Low seatbelt usage may be a particularly important indicator of a personality or behavioral profile that may increase risk for violence, especially for women. In addition, the consistent, though non-significant, trend in this small sample of female victims of increased risk for assault with increased self-reported worries and greater levels of job dissatisfaction coupled with low seatbelt use points to gender-mediated pathways for assault victimization. Hurst's study of self-esteem and health behaviors noted important gender differences that support what we find with regard to assault-related violence [34]. Specifically, for men they found that lower tobacco use and less exposure to dangerous situations were associated with greater self-esteem. While for women better perceived social support and greater use of seatbelts were associated with greater self-esteem. Self-esteem may be the underlying latent variable measured indirectly by the HRA survey indicators of safetybelt usage and social supports or work stress (for women) and perhaps tobacco use for men. We hypothesize that self-esteem may be the key factor to target for prevention of serious

assault. However, relatively small samples of women make it difficult to test this theory. More research is needed with larger samples of female victims and more detailed and direct assessment of self-esteem.

Heavy drinking was consistently associated with assault for both genders and was also the only single variable significantly associated with an assault-related hospitalization where there was documented alcohol comorbidity. However, it should be noted that for the vast majority of the assault hospitalizations alcohol was not indicated in any secondary diagnosis or in any transfer records related to continuation of care for the assault-related trauma. Where alcohol comorbidity was reported there appeared to be a greater likelihood of head-related trauma. This association between alcohol comorbidity and type of assault-related trauma could indicate that intoxicated victims are less able to protect themselves during violent events or perhaps are more likely to fall and sustain a head injury during a fight. Or, it could simply reflect variation in alcohol case finding. That is, injured assault victims presenting with a head injury, particularly if they are unconscious, may be more likely to undergo alcohol testing and evaluation than assault victims with other types of injury. Heavy drinkers may be more frequently drunk and thus more likely to be drunk during an assault, without necessarily being more likely to be assaulted. Or, heavy drinkers may have personality factors that correlate both with drinking habits and high risk personality traits – factors such as impulsivity and aggression, for example. Even though alcohol comorbidity is likely under-screened at the time of the hospital visit, prior drinking history appears to be associated both with assaults that include an alcohol diagnosis and those that do not.

This finding suggests that drinking patterns may increase risk for or are indicators of risk for future violence even when the victim has not been drinking and should be taken into account during routine screening for violence prevention.

Though not significant, the possible protective association between speeding and alcohol-involved assaults points to the need to better understand factors associated with speeding as a health risk behavior as compared to safety belt usage. Some studies suggest that speeding is associated with extroversion and has been linked to self-assertiveness [52]. This factor might, therefore, be protective against violence, particularly for women. Again, because there were relatively few cases of assault with documented alcohol involvement, more data are needed in order to test this theory.

In summary, alcohol comorbidity was not diagnosed for the majority of these serious assault victimization events, yet alcohol use patterns are important predictors of assault victimization, both when alcohol is AND when alcohol is not directly involved. A priori independent assessment of alcohol use patterns and ability to follow subjects with little loss to follow-up is a key strength of this study as is the ability to measure a wide range of health and social behaviors, a priori and independent of the assault outcome, on a highly-functioning fully employed occupational cohort with full access to health care. The Army hospital system's relatively complete coding of injury cause make it possible to identify unique individuals and unique events, to select assault events with a high degree of certainty and to identify the full spectrum of care including hospitalizations related to continued care in another medical facility.

Results from this study suggest that there may be gender differences in the pathway for assault victimization. We hypothesize that these variations in risk patterns may reflect different manifestations of low self-esteem. Low safetybelt usage, heavy drinking, and life stressors/job worries or poor social supports for coping with these things may be important predictors of low self esteem and ultimately greater risk for violence for women. For men, tobacco use may reflect the same pattern. More research is needed to test these hypotheses. For both men and women heavy drinking, drinking and driving and low safetybelt usage are important targets for screening and prevention of assault-related violence and/or other adverse injury-related outcomes.

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ALCOHOL ABUSE AND ALCOHOLISM, MENTAL HEALTH DISORDER, AND INJURY HOSPITALIZATION HISTORY AND OTHER RISK FACTORS FOR COMPLETED SUICIDE: A CASE-CONTROL STUDY OF 7,492 ENLISTED ARMY SOLDIERS

Authors:

Nicole S. Bell, ScD, MPH (1)

Thomas C. Harford, PhD (2)

Paul J. Amoroso, MD (3)

Ilyssa E. Hollander, MPH (1)

Affiliations:

1. **Social Sectors Development Strategies, Inc. Boston, MA, USA**
2. **Boston University School of Public Health, Boston, MA, USA**
3. **U.S. Army Research Institute for Environmental Medicine, Natick, MA, USA**

Corresponding Author: Dr. Nicole Bell, 2330 S. Third St. Tacoma, WA 98433-1038; Phone/Fax: 253/399-2828, e-mail address: nbell@ssds.net

Work performed at:

US Army Research Institute of Environmental Medicine, Kansas St., Building 86, Natick, MA 01760-5007, and SSDS, Inc. West: 2330 S. Third St. Tacoma, WA 98433-2038, and Department of Social and Behavioral Sciences, Boston University School of Public Health 715 Albany Street, Boston, MA 02118

ALCOHOL ABUSE AND ALCOHOLISM, MENTAL HEALTH DISORDERS, AND INJURY HOSPITALIZATION AND OTHER RISK FACTORS FOR COMPLETED SUICIDE AMONG YOUNG ADULT MALES: A CASE-CONTROL STUDY OF 7,492 ENLISTED ARMY SOLDIERS

Authors:

Nicole S. Bell, ScD, MPH

Thomas C. Harford, PhD

Paul J. Amoroso, MD

Ilyssa E. Hollander, MPH

Abstract

Aims: Assess the history of alcohol abuse and alcoholism, mental health, and injury hospitalizations and their interactions and associations with suicide among young, employed U.S. Army soldiers.

Design/Participants: 1,873 completed suicides were identified via review of Army death, inpatient and emergency room records between January 1, 1980 and December 31, 2003. 5,619 randomized controls were matched to cases. Hospitalizations occurring prior to, and independent of, the suicide event were reviewed. Where injury was the primary diagnosis we evaluated Army hospital cause codes to assess injury intentionality and cause (mechanism).

Findings: In multivariate models, increasing age, male gender, white race, single marital status and enlisted (versus officer) rank were all associated with suicide. In addition, prior injury (OR = 1.96, 95% CI = 1.59-2.43), alcohol (OR =3.37, 95% CI = 2.30-4.94), and mental health hospitalizations (OR = 6.63, 95% CI = 4.77-9.20) were all associated with suicide. Risk for suicide was greatest immediately after diagnoses was made, particularly for alcohol and other mental health disorders, but remained significantly elevated even after five years or more of follow-up. Most injury hospitalizations were unintentional but were, nonetheless, associated

with increased risk for subsequent suicide, particularly when the cause of injury was guns or poisoning, but also for machinery and fall-related injuries.

Conclusion & Recommendation: Soldiers with mental health disorders are discharged from the Army earlier than those with other health problems. Given the strong association between mental health disorders and suicide, longer follow-up of these soldiers is warranted, particularly given the alarming increases in suicides over the past decade.

Key Words: suicide, alcohol, mental disorder, injury, Army

Introduction

Suicide rates have increased across adolescent and young adult populations of North American and Europe (1). In the United States, there were 31,655 completed suicides in 2002 making suicide the 11th leading cause of death, with an age-adjusted rate of 11.0/100,000 (2). Demographic risk factors include male gender, white race, and age. Men comprised 80% (N = 25,409) of the completed suicides in 2002 for a male age-adjusted rate of 18.4/100,000 compared to the female rate of 4.2/100,000 (3). Non-Hispanic whites experience an age-adjusted rate of 12.8/100,000, compared to 6.0/100,000 for Hispanics and 5.3/100,000 for African Americans in 2002 (3). Suicide is the third leading cause of death among those 18-30 and the fourth leading cause of death among those 31-50 years of age (4).

One of the stronger predictors of suicide is making a previous, unsuccessful attempt or demonstrating parasuicidal behavior (5-8). Beautrais' (2004) analysis from a 5-year study of 302 individuals making a medically serious suicide attempt indicated that 6.7% ultimately committed suicide and 37% made at least one other (second) nonfatal suicide attempt (9). Grossman et al. (1993) found an increased risk for suicide among young adults (age 16-35) who had prior injury hospitalizations including unintentional injuries (10). Several other studies have documented associations between completed suicide and gun ownership (11-14), falls (15), drug overdose (16), and automobile accidents (17). Unintentional and intentional prior injury hospitalizations, whether self-inflicted (suicidal/parasuicidal behavior) or not (assault), may be associated with the same set of risk factors that relate to suicide (gun ownership, alcohol use, risk-taking, etc.) and thus provide a sentinel event by which to identify individuals potentially at increased risk for future suicide attempts.

Numerous studies have documented an increased risk for suicide among individuals suffering from a wide range of psychiatric conditions including affective disorders (18), personality disorders (19), schizophrenia (20-22), and organic mental disorders (23). Harris and Barraclough (1997) conducted a meta-analysis of data from 249 prospective studies and report that suicide risk is highest for functional disorders, intermediate for substance abuse, and lowest for organic disorders (24). Suicide is considered the most serious complication of affective disorders, with 6% percent of those afflicted ultimately committing suicide (25). In a case-control study of medically serious suicide attempts among young people attending a New Zealand clinic, 91% had lifetime history of some form of psychiatric illness and 71% showed signs of affective disorder at the time of the suicide attempt (26).

Alcoholism is also commonly associated with completed suicide (27-31) and, after affective disorders, is the most frequent diagnosis among those who attempt, as well as complete, suicides (24, 32). In a 40-year prospective study of Norwegian conscripts, Rossow and Amundsen (1995) found the risk for suicide was 5 times higher among alcohol abusers (33). Inskip et al. (1998) found that suicide risk is most pronounced at the time of diagnosis for affective disorders and schizophrenia. In contrast, suicide risk is uniform throughout the lifetime of individuals diagnosed with alcohol dependence (25). Individuals suffering from multiple mental health-related disorders also face increased risk for suicide, particularly from the combination of affective disorder, major depression or other psychiatric disorders and substance abuse (34-36). Cheng (1995) reported a stronger association between suicide and comorbid substance abuse disorder and depression compared with major depression without substance abuse (34). In a case-control study of adults age 18 years and older, Conner et al. (2003), adjusting for demographic and other diagnostic categories, found that mood disorder did not

moderate the association between alcohol dependence and suicide. The association was however moderated by age such that the association between alcohol dependence and suicide risk increased with older age (35).

Theoretically, there are two general ways in which alcohol consumption may be associated with risk of suicide (37-39): acute intoxication and chronic abuse. Hayward et al. (1992) reported that 36 percent of suicide victims had a positive blood alcohol concentration (0.001 or greater) (40). Acute intoxication may relate directly to suicide through a number of mechanisms (e.g., disinhibition or heightened impulse susceptibility, alcohol-induced depression, and modeling influences of significant others) and, indirectly, by putting people in risky situations in which they engage in potentially destructive behaviors that they subsequently regret. In a study of patients hospitalized after attempted suicide by self-poisoning, Merrill and colleagues (1992) found that almost half of these patients reported alcohol consumption in the 12 hours prior to poisoning themselves (41). Chronic abuse over time may indirectly relate to suicide by weakening social integration (38). Alcohol may also be associated indirectly with suicide through covariance with other risk factors such as social isolation, unemployment and medical problems.

In April of 2006 the U.S. Army released data indicating that suicides among Army soldiers had increased and were at their highest levels since 1993. In U.S. military populations, suicide accounts for 13 percent of all fatalities (42) and this proportion has increased in recent years. Rates climbed from 9.1/100,000 in 2001 to 13/100,000 in 2005 (43). These alarming increases suggest the need to investigate potential risk factors and moderators of suicide among Army soldiers. This study examines the associations between alcohol-related and other mental health disorder hospitalizations, prior injury hospitalization, and other background variables with

suicide among U.S. Army soldiers. Military populations offer large and diverse samples often with very complete information on hospitalizations, demographics and other factors associated with suicide which may be generalizeable to other populations as well (32, 33, 44, 45). The following hypotheses are explored: (1) alcohol-related and other mental disorder hospitalizations are significant and independent predictors for completed suicide; (2) prior injury requiring hospitalization is a significant predictor for completed suicide; (3) the associations between alcohol hospitalizations are moderated by age, gender, and injury/mental health hospitalizations.

Design

Data

Data were extracted from the Total Army Injury and Health Outcomes Database (TAIHOD) (46, 47). The TAIHOD is a collection of data files containing demographic and health information on active-duty Army personnel. Portions of the TAIHOD used in this paper include Army Casualty (death) files, hospital data from the Army Individual Patient Data System, and personnel records from the Defense Manpower Data Center (DMDC). Data on soldiers who left the Army prior to their death were not available for analysis, although those which occur within 120 days post discharge are included in the Army files.

Measures

Suicide. We identified a total of 1,873 suicide cases for this study using death records, inpatient hospital records and emergency room deaths. Death records include information on manner of

death including whether or not the death was determined to have been caused by suicide. However, details regarding cause of death are not available in the death records. There were 1,780 completed suicides identified in the Casualty death file. Some individuals who attempted suicide were hospitalized to treat their injury but, nonetheless, died from the self-inflicted injuries. Hospital data on these individuals include not only primary and secondary ICD-9-CM diagnoses but also injury cause (specific mechanism, such as firearms) and intent based on a NATO cause coding system (STANAG 2050) (48, 49). We were able to identify 102 hospitalized suicide cases who died while in the hospital. Most suicide victims with inpatient hospital records also had a death record indicating suicide as the cause of death (N=85, 83%). But, seventeen inpatient suicide-related deaths lacked a death record where cause of death was coded as suicide. Thus, exploration of the hospital files allowed us to identify an additional 17 suicide cases that would otherwise have been missed if we used the death file alone.

Some suicide victims were initially treated in emergency rooms or died during transport to a hospital but were never actually admitted to the hospital. Since these cases are not admitted to the hospital they do not generate a traditional hospitalization record. However, it has been Army treatment facility policy to create a special record for these death cases. These administrative records termed “carded for record only” (CRO), are seldom used in research, but can be especially useful for determining injury cause of death. They are coded using the same STANAG activity and intent codes as inpatient records.

Review of these CRO records allowed us to identify and obtain more complete and detailed information on 661 suicide cases. Five-hundred eighty-five of these CRO suicide cases also had death records indicating suicide as cause of death while 76 did not. Thus, combining data from the casualty file, the inpatient records, and the CRO records allowed us to identify a

total of 1,873 suicides. Ninety-three additional cases were found through investigation of inpatient and CRO records that would not have been located had we relied solely on the casualty files to identify suicide cases.

Hospitalization. Analyses of prior hospitalization records were restricted to just those hospitalizations occurring closest, and prior, to the suicide event because unique proximal events, compared to multiple prior hospitalizations, are more appropriate when examining interactions between injury, alcohol, and other mental health disorders as well as interactions based on interval between hospital discharge and suicide. In addition, while more information may have been gleaned by including other hospitalization events the actual numbers of multiple mental illness hospitalizations excluding alcohol (< 1%) and multiple alcohol hospitalizations (< .02%) are quite small.

Injury. We examined injury hospitalizations for cases and controls who experienced a hospitalization prior to the suicide event, distinguishing between hospitalizations associated with the suicide and those occurring prior, and unrelated, to the actual suicide event. Time between discharge from the closest prior non-suicide-related hospitalization and the suicide date was also included in the model in order to assess the influence of diagnosis proximity on subsequent suicide risk. Injury cause codes were obtained from the STANAG system for coding causes and intent (48, 49). A dummy variable was constructed indicating whether or not the primary diagnosis was injury, excluding physical training, battle-related or the result of legal intervention.

Mental disorders. We included mental-health related hospitalizations occurring prior to the suicide event (ICD-9 codes 290-315). Each ICD code was based on first appearance in the list of

8 possible diagnoses for each hospitalization. Two variables were constructed including alcohol-related diagnoses (ICD-9 291, 303, 305A, 571, and 980) and all other mental health disorders.

Demographic variables. Characteristics of study subjects included age (in years), years of military service, gender, race/ethnicity (black, Hispanic, white), education, marital status, dependent children (children < 19 living in the household at incident), and service grade (junior enlisted = E1-E4, midlevel enlisted = E5-E6 and senior enlisted = E7-E9, warrant officer, commissioned officer).

Participants

We compiled data from casualty death files, hospitalization and CRO records in order to identify all suicides among active-duty soldiers in the U.S. Army between January 1, 1980 and December 31, 2003 and for whom there was personnel data in the DMDC file within twelve months of the suicide date. We randomly ordered and selected controls on a 3:1 ratio with cases using the incident (suicide) date to identify eligible controls based on their active-duty status at the time of the suicide. Preliminary analyses indicated significantly lower numbers for suicide cases among officers (Warrant and Commissioned Officers) when compared to enlisted soldiers. However, review of models stratified on rank (officer/enlisted status) suggested that suicide risk factors were similar so the groups were combined. There were 1,873 suicide cases and 5,619 controls.

Analysis

Linear logistic regression analyses were conducted to examine associations between prior hospitalization and subsequent suicide using only those hospitalizations closest to, and independent of, suicide. Analyses were conducted in two stages. In the first stage, we conducted

separate logistic regression analyses for all background variables. In the second stage we included interaction terms for injury, alcohol, and other mental disorder hospitalizations and gender and age interactions with each type of hospitalization. Using a backward elimination process, all non-significant interaction terms were eliminated from the model while at the same time all main effects were retained. In separate models for injury, alcohol, and other mental health disorders, two- and three-way interactions were included to determine if hospitalization associations with suicide were moderated by interval between hospital discharge and suicide event date. Other models examined both main effects and interactions for specific mental health disorder categories. Analyses were conducted in SAS, version 8.2 (50). All analyses for this project adhere to the policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

Findings

The distribution of case status by demographic factors, together with results from logistic regressions, is shown in Table 1. The mean age for cases and controls is 27.6 years (age range = 17 to 63) and the mean time in service is 6.6 years (range = < 1 to 30 years). In the adjusted model, in contrast to the unadjusted model, increasing age is significantly related to suicide (Table 1). In separate analyses (data not shown), education is identified as the major confounder affecting the direction of the age association. In adjusted models, male soldiers are more likely to commit suicide, while soldiers who are black, college-educated, married, and in officer service grade are less likely to commit suicide. Hispanic ethnicity and presence of dependent children are not significantly related to suicide.

Soldiers with injury hospitalizations closest and prior to the suicide event date are twice as likely as controls to commit suicide. Soldiers with an alcohol-related diagnosis during a prior hospitalization are three times as likely as controls to later commit suicide, and soldiers with non-alcohol mental health diagnoses are seven times as likely as controls to commit suicide.

INSERT TABLE 1 ABOUT HERE

Thirty-nine percent of cases and 27.7% of controls experienced at least one hospitalization prior to the suicide-event date. Among hospitalizations closest to the incident date (N = 2,286), mental disorders and injury/poison comprise approximately 48.9% of hospitalization diagnoses for cases but only 22.1% for controls. Overall, the proportion of mental disorders hospitalizations (12.3%) is lower than the proportion of injury/poison hospitalizations (18.4%), but among suicide cases (N=730), 26.6% of primary hospitalization diagnoses are mental health disorders and 22.8% are injury/poisons. Whereas among controls (N= 1,556), 5.5% are mental disorders and 16.5% are injury/poisons. For the total sample (N = 7,492), mental disorders (OR=8.70, CI=6.57-11.53) and injury/poisons (OR=2.26, CI=1.80-2.84), when compared to other hospital diagnoses or no prior hospitalization, are significantly related to suicide (data not shown).

Four hundred eighty four (21.2%) of the 2,286 hospitalizations closest to the incident date are injuries and the majority of these injuries are coded as “unintentional” (91.5%), while only 4.1% are intentionally self-inflicted and 3.1% result from assault. Experiencing an unintentional injury-related hospitalization is significantly related to subsequent suicide (OR=1.32, CI=1.06-1.64) and prior assault-related injury hospitalization borders on significant (OR=2.69, CI=0.97-7.44, $p < .06$). Injury mechanism (cause) is strongly related to case (suicide)

status. Particularly injuries resulting from guns (OR=11.92, CI=5.53-25.96) and poisoning/corrosives (OR=5.71, CI=3.09-10.54) are strongly related to subsequent risk for suicide. Even injuries resulting from machinery (OR=2.34, CI=1.34-3.89), and falls (OR=1.47, CI=1.00-2.15) are significantly related to risk for subsequent suicide (data not shown).

The mean time between closest prior hospitalization and suicide event date for cases is 302.9 days and 344.4 days for controls. The odds of a particular type of hospital diagnosis for cases versus controls is associated with interval (time) between the hospital discharge date and the suicide event date. Figure 1 displays the odds of each type of diagnosis (injury, alcohol, other mental disorders) for cases compared to controls by time since prior hospitalization. Shorter intervals are associated with larger odds ratios overall but particularly for mental health-related disorders, followed by alcohol-related diagnosis and then injury. Hospitalizations for alcohol- or mental health-related diagnoses occurring as long as 5 years prior to the event date are associated with significantly increased risk for suicide and included approximately 95% of alcohol and 94% of mental disorder hospitalizations. Injury-related hospitalizations occurring as much as 4 ½ years prior to the event date were associated with an increased risk for subsequent suicides and included approximately 92% of injury hospitalizations.

INSERT FIGURE 1 ABOUT HERE

In the adjusted model with interaction terms there are four significant interactions: alcohol x mental health ($p < .001$), alcohol x injury ($p < .01$), mental health x injury ($p < .01$), and gender x injury ($p < .05$)(data not shown). The second-order interaction of alcohol, mental health and injury hospitalization did not approach statistical significance. To better inform the interpretation for each of the interactions, separate logistic regression models, controlling for all background variables and prior hospitalization, were conducted (Table 2).

There is a significant and negative interaction between alcohol and mental health diagnoses. As shown in Table 2 (Model 1), the association between prior alcohol hospitalization and suicide is reduced by the inclusion of prior mental health hospitalization. More specifically, when compared to no alcohol or mental health hospitalization, the odds ratios are as follows: alcohol only (OR=5.85, CI=3.77-9.08), mental health only (OR=9.74, CI=6.69-14.18), both alcohol and mental health (OR=6.18, CI=3.45-11.07). Combined alcohol and mental health diagnoses yield lower odds compared to only mental health diagnoses.

There is also a significant and negative interaction between alcohol and injury hospitalizations. As shown in Table 2 (Model 2), the association between prior alcohol hospitalization and suicide is reduced by prior injury. When compared to no alcohol or injury, the odds ratios are as follows: alcohol only (OR=4.02, CI=2.64-6.11), injury only (OR=2.14, CI= 1.72-2.68), both alcohol and injury (OR=3.30, CI=1.41-7.69).

There is a significant and positive interaction between mental health diagnosis and injury. As shown in Table 2 (Model 3), the association between prior mental health hospitalization and suicide is increased by prior injury hospitalization. More specifically, when compared to no mental health or injury hospitalization, the odds ratios are as follows: mental health only (OR=5.61, CI= 3.94-7.99), injury only (OR=1.91, CI=1.52-2.39), both mental health and injury (OR=41.93, CI=12.85-136.80). Due to small sample size in the combined group (cases, N=49; controls, N=4) the confidence interval is very wide.

There is a significant and negative interaction between gender and injury hospitalization. As shown in Table 2 (Model 4), the association between male gender and suicide is reduced by prior injury, while the association between female gender and suicide is increased by prior injury (OR=4.87, CI=2.06-11.53). When compared to females with no prior injury hospitalization, the

odds ratios are as follows: males with no injury (OR=2.94, CI=2.24-3.84), females with injury (OR=4.87, CI=2.06-11.53), males with injury (OR=4.87, CI=2.06-11.53).

INSERT TABLE 2 ABOUT HERE

Discussion

The risk for completed suicide, adjusted for background variables, is significantly related to having experienced a prior alcohol- or mental health-related hospitalization, particularly when these occurred within less than five years of the suicide event date. These findings are consistent with studies of other military populations (32). In addition, prior hospitalization for injury is also related to suicide. The association between prior hospitalization and suicide event date is moderated by the length of time between prior hospitalization and event date; Shorter intervals are associated with larger odds ratios. But, hospitalizations for alcohol and other mental disorders that occurred as long as five years prior to the event date are still associated with a significant increased risk of suicide.

Inskip et al. (1998) report that suicide risk is most pronounced at the time of diagnosis for individuals diagnosed with affective disorders and schizophrenia (25). We also found that suicide risk is highest for shorter intervals between diagnosis and suicide event, including the subcategories for mental disorder. Unlike Inskip et al., however, we do not find a uniform risk of association between alcohol and suicide over a long time period. Instead, the association between an alcohol-related diagnoses and suicide appears strongest when diagnosed close to the suicide date. The strength of the association drops off over time and is no longer significant after five years. However, the influence of timing (proximity of the diagnosis vis-à-vis the suicide date) is more pronounced for mental health diagnoses where the association is very strong within

a short period of time but drops off more rapidly with successively longer periods of time between initial diagnosis and suicide event date. Some of the difference between our findings and Inskip et al. may be related to a healthy worker bias. That is, soldiers with serious alcohol-related problems are not likely to remain on active duty and thus there may not be a long enough follow-up period for those with more serious alcohol problems to fully evaluate the magnitude of the effect of alcohol.

While close proximity of the hospitalization to the event date was associated with larger odds ratios, it is nonetheless interesting to note that injury hospitalizations occurring as much as four and a half years prior to the event date were related to suicide. Even reportedly unintentional injuries caused by guns/explosives (not during war), machinery/tools, poisons/corrosives, and falls were significantly higher among suicide cases than controls. These types of injuries, even when not coded as intentional, may represent proxy indicators for prior suicide attempts, a factor significantly related to completed suicide. They may also result from a constellation of risk factors that not only predispose individuals to these types of injuries but also to suicide. Prior injury hospitalization may include suicide attempts not correctly identified or documented as such in the hospital record. It may not always be possible to ascertain whether an injury is self-inflicted or intentional and, even if known, intent may not be recorded. Grossman et al. (1993) found an increased risk for suicide among young adults (age 16-35) with prior injury hospitalizations including unintentional hospitalizations (10). The vast majority of injuries in the present study (87%) were unintentional (30 cases of intentional injury were all associated with completed suicides). Unintentional and intentional injury hospitalizations may provide sentinel events by which to identify individuals who may be at increased risk for future

suicide attempt. Further research is needed in order to better characterize these prior injury events.

The associations between alcohol and other mental disorders and suicide need to be interpreted in light of their significant negative interaction. Suicide risk associated with both alcohol and other mental disorders was slightly lower than the risk associated with mental disorders alone. These findings indicate that mental disorders with or without alcohol disorders pose a greater risk for suicide compared to alcohol disorders alone. Alcohol disorders, absent of any comorbid association with mental disorders, were significant predictors of suicide. Hoge et al. (2002) reports greater likelihood of early discharge from the Army among soldiers with mental health disorders compared to other health-related problems. Thus, there may be urgent need for greater follow-up of soldiers with certain mental health and alcohol-related disorders once they leave active duty to assess possible increased risk for suicide (51). The full impact of mental health disorders on suicide risk cannot be fully enumerated without a better understanding of the outcomes among soldiers discharged from the Army with mental health disorders.

One unexpected finding from the present study was the variation in interaction patterns for alcohol and injury versus mental health disorders and injury. The odds for suicide were reduced for injury with concurrent alcohol comorbidity but were substantially increased for mental health hospitalizations with injury. In the case of mental health hospitalization, the injury may reflect an unsuccessful suicide attempt. The absence of a similar association for alcohol and injury may relate to level of injury severity, amount of alcohol consumption or type of alcohol diagnosis (chronic and acute intoxication are combined in our measure of alcohol diagnosis). It is also possible that Army policy regarding obligatory reporting and assessment (and possibly

treatment) when there is an alcohol-related medical diagnosis results in reduced risk for suicide.

Several additional findings are worth highlighting. Increased age and male gender were significantly related to suicide while black and college-educated soldiers were less likely to commit suicide. In unadjusted models, marital status, presence of dependent children, and higher service grade exhibited lower risk for suicide, but these variables were no longer significant in adjusted models. Hispanic ethnicity was not significantly related to suicide. In contrast to the findings of Conner et al. (2003), age did not significantly modify the associations between types of prior hospitalization and suicide. This is probably because of the relatively young and small age range of active-duty military. The national suicide rates for ages 20 through 54 years, the ages of most active-duty servicemembers, only slightly increase over this age range but increases dramatically among those age 70 years and older. In addition, pre-enlistment screening and high wash out rate of new recruits who have trouble adjusting to military life or show signs of mental health problems may also explain some of the difference in findings (52).

Among the hypothesized gender interactions, only injury hospitalization was moderated by gender, indicating that females with injury hospitalizations were more likely to commit suicide. Women, in general, are at lower risk for injury-related hospitalizations. Thus, those few women who are hospitalized with injury are an important group for targeted prevention and may represent individuals who are risk-takers, substance abusers or victims of violence, or these injuries may be unrecognized suicide attempts. Unintentional injury hospitalization among women might be an important sentinel event warranting more intensive screening and prevention efforts.

Among study limitations, findings related to the small numbers of specific ICD-9 diagnostic categories and for female soldiers, pose problems for reliability and comparison with other studies. There are other potential risk factors for suicide that were not available for study. The sample characteristics of military populations may limit comparison with other studies and generalization to other populations.

Despite these limitations, there are several key strengths to this study. The ability to follow soldiers over long periods of time and the ability to link demographic and hospitalization records to suicide mortality are major strengths of this study.

Conclusion

Hospitalization for mental health disorders, alcohol abuse and injury are all associated with subsequent suicide. This is particularly true for mental health disorders which are strongly associated with suicide, even when the hospitalization occurs five years or more in the past. The highest risk period is immediately following diagnoses, particularly for mental health-related disorders. This suggests the need for greater vigilance during the months immediately following diagnosis. The interaction between gender, injury and suicide indicates injured women, even those hospitalized for unintentional injury, should be screened for potential suicide risk. More research is needed to better understand the etiology of this association. Finally, better long range follow-up of soldiers discharged from the Army with mental health or alcohol-related conditions are warranted.

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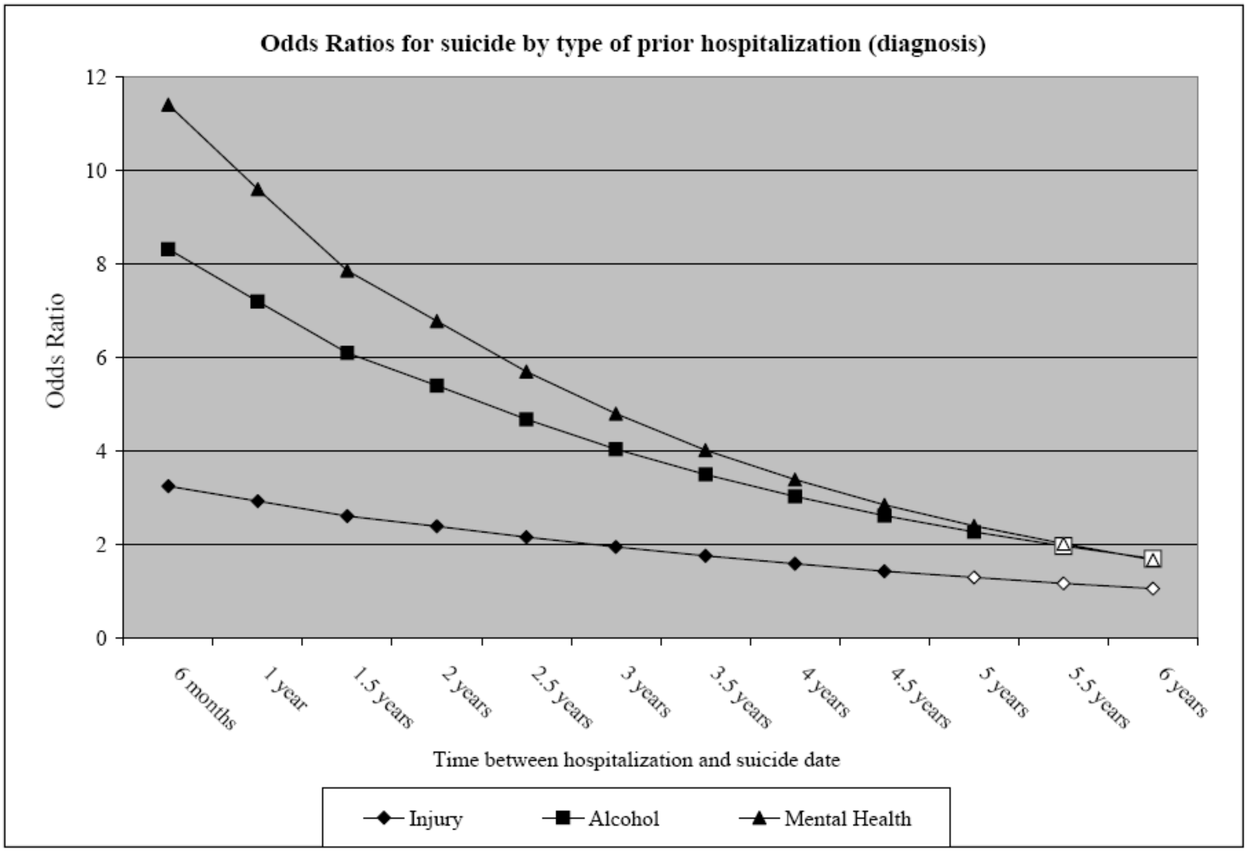
Table 1. Distribution of demographic factors by case status (suicides and controls) among active-duty U.S. Army soldiers. Results from univariate (crude) and adjusted logistic regression analysis.

Characteristic[1]	Cases (N=1,873)	Controls (N= 5,619)	Total (N=7,492)	Unadjusted OR (C.I., 95%)	Adjusted OR[2] (C.I., 95%)
Age in years	27.2	27.8	27.6	0.99 (0.98-0.99)	1.02 (1.00-1.04)
Time in service in years	6.3	6.7	6.6	0.99 (0.98-0.98)	0.97 (0.94-0.99)
Gender					
Female	4.6	11.8	10.0	1.00	1.00
Male	95.4	88.2	90.0	2.79 (2.21-3.51)	2.75 (2.14-3.55)
Race/ethnicity					
White	70.9	63.7	65.5	1.00	1.00
Black	19.5	27.3	25.4	0.64 (0.56-0.73)	0.64 (0.56-0.74)
Hispanic	9.6	10.0	9.1	0.96 (0.80-1.16)	0.95 (0.78-1.16)
Education					
Non-college	86.3	78.0	80.0	1.00	1.00
College	13.7	22.0	20.0	0.56 (0.49-0.65)	0.69 (0.55-0.87)
Marital status					
Not married	50.3	45.1	46.4	1.00	1.00
Married	49.7	53.6	53.6	0.81 (0.73-0.90)	0.84 (0.72-0.99)
Children < 18 years in household					
No	64.5	60.9	61.8	1.00	1.00
Yes	35.5	39.1	38.2	0.86 (0.77-0.96)	0.94 (0.80-1.12)
Service grade					
E1-E4	54.7	50.2	51.3	1.00	1.00
E5-E6	28.0	26.2	26.7	0.98 (0.87-1.11)	1.17 (0.97-1.40)
E7-E9	10.3	9.2	9.5	1.02 (0.85-1.22)	1.39 (1.01-1.91)
Warrant officer	1.0	2.1	1.8	0.42 (0.25-0.69)	0.49 (0.25-0.95)
Commissioned officer	6.0	12.2	10.7	0.45 (0.37-0.56)	0.66 (0.47-0.93)
Prior closest injury hospitalization					
None	88.9	95.0	93.5	1.00	1.00

Yes	11.1	5.0	6.5	2.36 (1.96-2.85)	1.96 (1.59-2.43)
Prior closest alcohol hospitalization					
None	94.6	99.0	97.9	1.00	1.00
Yes	5.4	1.0	2.1	5.72 (4.11-7.96)	3.37 (2.30-4.94)
Prior closest mental disorder hospitalization					
None	91.0	98.8	96.9	1.00	1.00
Yes	9.0	1.2	3.1	8.28 (6.20-11.07)	6.63 (4.77-9.20)

1Missing data for age (8 cases; 6 controls); gender (1 case, 4 controls); race (85 cases; 209 controls); education (53 cases; 92 controls); marital status (29 cases; 66 controls); children (52 cases; 128 controls); service grade (2 controls).
2 Missing data includes 175 cases and 444 controls for total n = 6,873.

Figure 1. Odds Ratios for suicide by time since most recent hospitalization and by diagnosis



*Statistically significant (p<=.05) Odds Ratios shown in black
Notes:
Covariates in the models include: Time in service, Gender, Race/ethnicity, Education, Marital status, Children < 18 years in household, Service grade

Table 2. Distribution of estimated adjusted odds ratios and 95% confidence intervals for suicide by background characteristics and interactions among enlisted active-duty US Army soldiers (N = 7,492).*

Characteristic	Model 1	Model 2	Model 3	Model 4
Age in years	1.02 (1.01-1.04)	1.02 (1.01-1.04)	1.02 (1.02-1.04)	1.02(1.02-1.04)
Time in service in years	0.97 (0.95-0.99)	0.97 (0.95-0.99)	0.97 (0.95-0.99)	0.97 (0.95-0.99)
Gender				
Female	1.00	1.00	1.00	
Male	2.78 (2.15-3.59)	2.71 (2.11-3.50)	2.72 (2.11-3.51)	See interaction
Race/ethnicity				
White	1.00	1.00	1.00	1.00
Black	0.64 (0.56-0.74)	0.64 (0.55-0.74)	0.64 (0.56-0.74)	0.64 (0.56-0.74)
Hispanic	0.96 (0.79-1.17)	0.96 (0.78-1.17)	0.96 (0.79-1.17)	0.95 (0.78-1.16)
Education				
Non-college	1.00	1.00	1.00	1.00
College	0.69 (0.55-0.87)	0.69 (0.55-0.87)	0.69 (0.55-0.87)	0.69 (0.55-0.86)
Marital status				
Not married	1.00	1.00	1.00	1.00
Married	0.85 (0.72-0.99)	0.84 (0.72-0.99)	0.84 (0.72-0.99)	0.84 (0.72-0.99)
Children < 18 years				
No	1.00	1.00	1.00	1.00
Yes	0.95 (0.80-1.13)	0.95 (0.80-1.12)	0.94 (0.75-1.12)	0.95 (0.80-1.12)
Service grade				
E1-E4	1.00	1.00	1.00	1.00
E5-E6	1.15 (0.96-1.38)	1.17 (0.97-1.40)	1.17 (0.97-1.40)	0.46 (0.97-1.39)
E7-E9	1.36 (1.01-1.87)	1.37 (1.01-1.88)	1.37 (1.01-1.88)	1.37 (1.01-1.88)
Warrant officer	0.45 (0.23-0.89)	0.48 (0.24-0.93)	0.48 (0.25-0.94)	0.48 (0.25-0.94)
Commissioned officer	0.66 (0.47-0.93)	0.67 (0.44-0.94)	0.66 (0.47-0.93)	0.66 (0.47-0.93)
Interval (in days)	1.00 (0.99-1.01)	1.00 (0.99-1.01)	1.00 (0.99-1.01)	1.00 (0.99-1.01)
Prior closest injury hospitalization				
None				

Yes	2.04 (1.64-2.54)	See interaction	See interaction	See interaction
Prior closest alcohol hospitalization				
None				
Yes	See interaction	See interaction	3.42(2.33-5.01)	3.36 (2.29-4.92)
Prior closest mental disorder hospitalization				
None				
Yes	See interaction	6.63 (4.77-9.22)	See interaction	6.65 (4.78-9.24
Interactions				
Alcohol	5.85 (3.77-9.08)			
Alcohol x Mental Disorder	0.63 (0.32-1.25)			
Alcohol		4.02 (2.64-6.11)		
Alcohol x Injury		1.54 (0.65-3.67)		
Mental Disorders			5.61 (3.94-7.99)	
Mental Disorders x Injury			22.0 (6.61-73.2)	
Male gender				4.87 (2.06-11.5)
Male gender x Injury				1.94 (1.55-2.43

* Missing data includes 175 cases and 444 controls for total n = 6,873.

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Gender differences in risk factors for victims of spouse abuse:

Behavioral, psychosocial, and demographic patterns

Carolyn E. Schwartz, ScD[1, 2, 3]

Nicole S. Bell, ScD[1, 4]

Ilyssa E. Hollander, MPH[1]

Paul J Amoroso, MD[5]

Author Affiliations:

[1]Social Sectors Development Strategies, Inc., Boston, MA
[2]DeltaQuest Foundation, Concord, MA
[3]University of Massachusetts Medical School, Worcester, MA
[4]Boston University School of Public Health, Boston, MA
[5]Madigan Army Medical Center, Tacoma, WA

Corresponding Author:

Dr. Carolyn Schwartz
SSDS, Inc.
31 Mitchell Road
Concord, MA 01742
Phone: 978-758-1553
Fax: 978-318-7914 (call first)
E-mail: cschwartz@ssds.net

Abstract

Objective: To identify risk factors for spouse abuse victimization and to determine gender differences in these factors. **Methods:** This case-control study compares active-duty enlisted Army soldiers who were spouse abuse victims between 1989 and 2002 to controls matched on marital status and military rank. **Results:** Victims were younger, less educated, non-Caucasian, lower-ranked, and spent fewer years in service than controls. Spouse abuse perpetration history increased victimization risk (OR=26.8 for women, 67.6 for men), particularly if perpetration was ≤90 days of the victimization event (OR=8.3 for women, 17.6 for men). For males, history of problem drinking and imbibing ≥15 drinks per week increased victimization risk (OR=1.24). Hierarchical multiple logistic regression revealed that: (1)alcohol abuse is a risk factor for victimization among men only, and its effects are mediated by psychosocial variables; (2)having a college education is protective for men only; (3)prior perpetration (*ever)* is a risk factor for men, but for women only if perpetration ≤90 days of victimization. **Conclusions:** Alcohol-related problems, psychosocial factors, demographics, and prior perpetration history are independent risk factors for spouse abuse victimization. Associations vary by gender.

Key Words: alcohol, violence, intimate partner violence, gender, Army

Intimate partner violence is strikingly prevalent, affecting 5% to 20% of married couples,[1, 2],[3] There are gender and occupational differences in severe violence prevalence (e.g., beating choking, threatening with a knife/gun), with men reporting lower experienced moderate or severe abuse than females.[4] Army personnel seem to be at slightly higher risk for severe violence than civilians[4] and civilians have a documented 27% increase in wife assault over time, but a 50% decrease in lethal intimate partner violence over time.[5] However, these differences in military and civilian populations may be partially due to differences in detection/surveillance.

Physical and behavioral indicators of spouse abuse victimization may include unexplained bruises or welts, emotional constriction or blunted affect (see Miller and Veltkamp[6] for complete list). Spouse abuse victims tend to have higher rates of healthcare utilization[7] and more physical and mental health problems.[8] Victims have also been found to have a history of substance abuse, though causal order may be difficult to ascertain.[9] Research has documented associations between patterns of substance abuse and risk of victimization or perpetration,[10] and have found that women whose male partners abuse alcohol or drugs are at greatest risk for injury from domestic violence.[11] Thus, interventions focused on people who have, or are married to people with, substance abuse problems may be an effective way to reduce spousal abuse prevalence and severity.

Other potential mediating psychosocial factors include educational attainment, social support, economic status and interpersonal skills. For example, college completion has been observed to be protective against abusing or being abused,[12-14] and having adequate social support has been found to reduce the impact of victimization on physical and mental health,[15, 16] unless the victim

experienced severe violence.[17] Powerlessness is another risk factor, reflected by greater victimization risk among unemployed males[18] as well as greater risk of perpetration among male spouses who had less power.[19]

Victimization and perpetration of intimate partner violence are also closely related. Prior perpetrators of intimate partner violence are at greater risk of being abused,[20] suggesting that that there is a recursive pattern of violence that must be proactively recognized and mediated.

Although many risk factors are similar for males and females, there are documented gender differences in the role of anger expression[21] and verbal aggression.[22] Thus, risk factors for spouse abuse victimization should be examined separately by gender, although this focus is difficult due to limited samples of male and female victims from the same study population. The overall goal of this paper is to identify factors and early warning signs (sentinel events) associated with subsequent spouse abuse victimization in order to inform early intervention programs and to determine whether risk factors differ for male and female victims.

Main Research Hypotheses

H_A1: Demographic (e.g., age, education), health-behavioral (e.g., alcohol use), and psychosocial (e.g., family problems) risk factors for substantiated spouse abuse victimization will differ for male and female victims.

H_A2: Male and female victims of spouse abuse will be greater users of healthcare in the year prior to the substantiated abuse event.

Methods

Data Source

Data come from the Total Army Injury and Health Outcomes Database (TAIHOD), a compilation of files containing demographic and health information on active-duty Army personnel that can be linked through individual identifiers.[23, 24] This paper included TAIHOD data from the Army Central Registry (ACR) of child and spouse abuse data, Health Risk Appraisal (HRA) surveys, and personnel records (demographic and discharge information) from the Defense Manpower Data Center (DMDC), and hospitalization data from the Army Individual Patient Data System. Army policy only recognizes substantiated incidents of spouse abuse between married persons; therefore the ACR only contains information about interpersonal violence between partners if they were married at the time of the event. HRA surveys were completed by subjects prior, and unrelated to, the abuse incident.

Selection of Cases and Controls

Cases included any first-time victim of spouse abuse between 1989 and 2002. Social security numbers used to link databases were encrypted, and a de-identified analytic database was created. In addition, to eliminate potential selection bias in abuse reporting among officers, only enlisted soldiers were included as cases.

Controls were selected from a pool of eligible soldiers in the DMDC file consisting of married, enlisted soldiers in the Army between 1989 and 2002 who were not victims in the ACR file. Eligible controls were randomly sorted and then paired with cases of the same gender. Controls

were assigned incident dates to match the corresponding case record. A control could only be assigned to one case and each case was paired with three controls.

Measures

Alcohol Problems: The HRA was routinely offered to Army soldiers throughout the 1990s during in-processing to new job assignments, routine physical exams and was administered to entire units through the Army's health and wellness program. It includes measures of alcohol-related problems and weekly alcohol consumption.[25-28]

1. *Problem Drinking* (CAGE+2): Six HRA alcohol-related questions were used to define "problem drinking." Four items came from the CAGE, a screening measure used to detect problem drinking,[29] which stands for **C**ut Down, **G**uilty, **A**nnoy, **E**ye Opener.[a] Two additional questions about drinking were: "Do your *friends ever worry* about your drinking?" and "Have you *ever had a drinking problem*?" Respondents answering yes to two or more items were considered at greater risk for alcohol dependence and defined as positive for "problem drinking".[26]

2. *Alcohol Consumption Patterns*: Typical alcohol consumption was assessed by responses to the HRA question, "How many drinks of alcoholic beverages do you have in a typical week?" Responses were grouped into four categories based upon published guidelines for safe and unsafe drinking as follows: none ("abstainers"), 1-7 drinks, 8-14 drinks (heavy drinking for women), 15 or more drinks per week (heavy drinkers for men).[30-32] Although these self-reported items, as well as the weekly alcohol consumption measure, are susceptible to reporting bias, prior work has shown that they display good internal and external validity and are strong

[a] The actual questions are: Have you ever felt you should cut down on your drinking? Have people ever annoyed you by criticizing your drinking? Have you ever felt bad or guilty about your drinking? Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (eye opener)?

predictors of alcohol-related hospitalizations and early separation from service due to alcoholism.[26]

Psychosocial Factors: HRA measures of social support, social and family problems, and depression were included in this analysis. Items included the availability of support in general ("How often are there people available that you can turn to for support in bad moments or illness?"), family problems ("How often do you have any serious problems dealing with your husband or wife, parents, friends or with your children?"), job stress ("How often do you feel that your present work situation is putting you under too much stress?"), job satisfaction ("I am satisfied with my present job assignment and unit"), and depressed mood ("In the past year, how often have you experienced repeated or long periods of depression?"). Responses were dichotomized for ease of analysis (e.g., "always/sometimes" versus "hardly ever/never").

Demographic Factors: Demographic variables drawn from Army personnel files included gender, age, race/ethnicity, education, military rank, and number of years on active duty in the Army. Because grade and time on active duty were highly correlated, only grade was used in subsequent analyses.

Perpetrator History: Information about a soldier's prior history of perpetrating spouse abuse was evaluated by: (1) looking at the dichotomous indicator (i.e., yes versus no); (2) looking at time between perpetration event and victimization event only if the perpetration happened prior to the victimization event, and divided the time period along quartiles: 1-90 days prior; 91-365 days prior; 1+ to 3 years prior; more than 3 years prior.

Prior Health Care: All inpatient hospitalizations that occurred within one year of the incident event were examined. Using International Classification of Disease, 9th Revision, Clinical

Modification (ICD-9-CM) codes, hospitalizations were subsequently categorized into the following: injury (ICD 800 –995); alcohol-related;[b] mental health (ICD 290 – 319, excluding any alcohol-related diagnoses); dual diagnosis (at least one alcohol-related and one mental health diagnosis in the same hospitalization). ICD codes in any of eight possible diagnostic positions within a given hospitalization were used.

Data Analysis

Logistic regression analysis was used to identify associations between alcohol problems, socio-demographic characteristics, prior perpetration history, and prior hospital care. Risk factors were first examined in univariate models, and then together using a hierarchical strategy. If a risk factor was marginally significant for either gender (i.e., $p<0.10$), then it remained in the multivariate model so that gender comparisons could be made. In models 1, 2, and 3, alcohol problems were examined individually (model 1*)* and together (models 2 and 3) to examine whether one variable explained or mediated the other. In model 4, psychosocial factors were added as was a covariate adjusting for time between HRA completion and victimization event to control for potential confounders, such as poorer data quality with longer lags and possible bias that those who get hurt frequently may seek healthcare providers more often and may be more likely to be asked to complete HRA forms. Model 5 adds demographic variables, prior hospitalization within one year, and prior perpetration history to examine mediators of alcohol problems on victimization risk. Interactions between alcohol and other variables were tested but as none were statistically significant, they were not included them in the final multivariate

[b] For list of alcohol-related ICD codes, please contact author.

models. Because our primary interest was to assess gender-differentiated models, all analyses were stratified on gender.

Analyses were conducted using SAS version 8.02.[33] All analyses for this project adhere to the policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

Results

There were 26,066 cases and 78,198 controls. Of these 104,264 soldiers, 71.6% were men and 28.4% were women. Approximately 26% of cases (N=6,811) and 29% of controls (N=22,458) had taken a HRA prior to the event date. Table 1 provides descriptive statistics on cases and controls by gender for the demographic and health care utilization variables examined.

Among the subset of soldiers with HRA data, the lag between HRA and victimization event was evenly distributed. A substantial minority reported problems with family, depressed mood, social support, job stress, job satisfaction and alcohol, and males reported more alcohol problems than females (Table 2).

Univariate Analyses

Univariate logistic regression models revealed that both female and male victims were significantly more likely than matched controls to be younger, less educated, non-Caucasian, of lower grade, and have spent fewer years in service (see Table 1 for frequency distributions, odds

ratios (OR) and 95% confidence intervals (CI)). For both genders, soldiers under 25 years of age, and who had been in the Army for 1-3 years had the greatest odds for victimization.

Although victimization risk patterns for most covariates were similar for women and men, the effect size varied significantly by gender for perpetration history, and was modified by time since the reported event. Prior perpetration was a highly significant risk factor for victimization among both genders, but it was substantially higher for men (OR=26.8 for women and 67.6 for men), particularly if this prior perpetration was within 90 days of the victimization event (OR=8.3 and 17.6 for women and men, respectively). For women, the risk imposed by prior perpetration decreased substantially after 90 days and completely after one year, and actually became protective when the prior perpetration event was at least three years prior to the victimization event. For men, the victimization risk remained elevated for years.

There were also gender differences for two hospitalization variables (any hospitalization and dual diagnosis). Hospitalization for any reason, as well as alcohol-, injury-, mental health-, or dual diagnostic-related (alcohol and mental health) reasons, increased victimization risk for men. In contrast, hospitalization per se appeared protective against victimization for women. But, injury- or mental illness-related hospitalizations increased the risk of victimization for women (see Table 1).

Among the subset of HRA-takers (N=7,654 females and 21,615 males), unadjusted results revealed that reporting family problems, depressed mood, lack of social support, or low job satisfaction, and having a shorter time lag between the HRA and victimization event were all

significant risk factors for both genders. For men, symptoms of alcohol dependence and heavy drinking were associated with an increased risk of victimization (OR=1.27). Work stress was not a risk factor for either gender, but there was an inverse trend for females that bordered on significance ($p<0.10$) suggesting that it might be protective against victimization (see Table 2).

TABLES 1 AND 2

Multivariate Analyses

Hierarchical models indicated that **for women**, alcohol problems were not a risk factor for victimization (Table 3a). The protective effect of work stress for women ($p<0.08$) was mediated (completely explained) by demographic factors (Figure 1). For psychosocial risk factors, after adjusting for all other covariates, only self-reported family problems were associated with subsequent victimization. Though important in the univariate models, education was not a risk factor in the multivariate model, suggesting that this variable is mediated by other psychosocial or demographic variables. The addition of risk factors at each step of the hierarchical model significantly improved model fit ($p<0.0001$ for models 3, 4, and 5).

FIGURE 1 AND TABLES 3a and 3b

Though not significant risk factors for women, problem drinking and alcohol consumption patterns were significant risk factors for victimization **among men** in unadjusted models. However, the association between alcohol consumption patterns and victimization was mediated

by problem drinking and alcohol problems overall were mediated by psychosocial factors (Table 3b; Figure 1). Although all psychosocial variables were significant risk factors and mediated alcohol as a risk factor in model 4, only family problems and lack of social support remained significant predictors in the full model once behavioral and demographic factors were added to the model (model 5).

Health behavior risk factors also differed by gender (Figure 1). Whereas only reporting family problems and having a short ($\leq$ 1 year) time lag between HRA and event were significant risk factors for women, men's risk factors included these variables as well as low levels of reported social support (Tables 3a and 3b). Results also highlighted the following **gender differences** between men and women: (1) problem drinking is a risk factor for male but not female victimization, and its effects are mediated by psychosocial variables; (2) college is protective only for male victims; (3) prior perpetrator (*ever)* is a risk factor for men, but for women only if perpetration was within 90 days of victimization (see Figure 2).

FIGURE 2

Conclusions

This investigation revealed similarities and important differences among genders in risk factors for spouse abuse victimization. Men had a greater unadjusted risk of victimization if they reported alcohol problems, while alcohol abuse was not associated with women's risk of victimization. For men, the effect of alcohol abuse was mediated by the inclusion of

demographic and psychosocial variables in the full multivariate models. In both genders' multivariate models, family problems increased risk of victimization. While work stress decreased risk in univariate models, the protective effect of work stress was explained by behavioral, demographic, and health care utilization factors in the full models. Still, work stress may be an important indicator, possibly reflecting higher level work, or less time spent in the home and thus fewer opportunities for victimization. For both genders, prior perpetration considerably increased risk of victimization, and for men this risk remained elevated regardless of time between perpetration and victimization. For female victims, this risk was only increased with recent perpetration incidents. This finding could suggest that the reported victimization event may, in some cases, be retaliatory. More research is needed to test this hypothesis. Although a relatively small proportion of the study sample had initiated violence within the past three months, this was clearly a sentinel event for victimization.

This work utilizes a large, administrative data source to investigate risk factors for spouse abuse victimization. Accordingly, it has strengths and limitations common with this sort of epidemiologic enterprise. Strengths include large analytic samples offering statistical power to detect even small differences. Additionally, soldiers represented in the TAIHOD are quite diverse in terms of race, education level and age. Further, all study subjects were employed by the Army; thus, factors related to victim unemployment are not confounding our results. Nonetheless, administrative data have their limitations, including the ambiguity of some variables and constrained operationalizations of key behavioral and psychosocial constructs. For example, the time interval between HRA completion and victimization event remained a significant risk factor in all models, but its meaning is ambiguous. It could simply be an indicator for the currency and accuracy of the behavioral and psychosocial factors examined, but may also

be a proxy for attention received from the Army healthcare system, since soldiers seen by healthcare providers may be more likely to be asked to complete an HRA. The strong link between prior perpetration and subsequent victimization risk may also reflect surveillance bias. While bias could potentially contribute to the large OR, the literature supports the relationship[20] so it is not unreasonable to expect it is a real effect. Furthermore, our study was constrained by the reduced sample size for behavioral and psychosocial variables although this limitation is unlikely to introduce bias.[25] Finally, our study focuses on victims of spouse abuse, and does not consider perpetrator characteristics.

There are numerous implications of this work for early intervention to prevent spouse abuse. Perhaps most effective, according the magnitude of odds ratios, would be an intervention with any couple where at least one spouse is a documented perpetrator. For women, this would be most important immediately after the perpetration event whereas for men, one might intervene no matter when the perpetration event occurred. Another intervention technique could target lower-ranked soldiers. Attention should be paid to non-Caucasian soldiers, African-Americans in particular; and especially to soldiers who acknowledge family problems. Finally, any hospitalization appears to be associated with an increased risk of victimization, particularly mental health- and injury-related related hospitalizations for either gender, and alcohol- and dual-diagnosis-related hospitalizations for men. Thus, early interventions to prevent spouse abuse might earmark soldiers for psychosocial interventions by following up on soldiers with these diagnoses during the first year after hospitalization. Early intervention programs might focus on coping with family problems and finding alternative, non-violent approaches to anger management.

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Tables and Figures

Table 1. Frequency Distributions and Logistic Regression Odds Ratios of Demographic and Health Care Utilization Characteristics By Gender

Risk Factors	Women		Men	
	Frequency N (%) ***N= 29,580***	**Odds Ratio (95% Confidence Interval)**	**Frequency N (%)** ***N= 74,684***	**Odds Ratio (95% Confidence Interval)**
Age[a,b]				
<21	2,388 (8.1)	**7.66** (5.77, 10.17)	3,119 (4.2)	**11.49** (9.95, 13.27)
21-25	11,374 (38.5)	**6.67** (5.07, 8.76)	22,067 (29.6)	**9.35** (8.22, 10.63)
26-30	7,895 (26.7)	**4.35** (3.30, 5.73)	20,448 (27.4)	**5.70** (5.01, 6.49)
31-35	4,635 (15.7)	**2.95** (2.23, 3.91)	14,496 (19.4)	**3.54** (3.10, 4.04)
36-40	2,411 (8.2)	**1.87** (1.39, 2.53)	10,045 (13.5)	**2.13** (1.85, 2.45)
>40	861 (2.9)	1.00 (ref)	4,490 (6.0)	1.00 (ref)
Education [b]				
≤ High School/GED	25,602 (87.7)	**2.52** (2.15, 2.96)	67,148 (90.5)	**2.67** (2.36 – 3.03)
Some College	2,184 (7.5)	**1.36** (1.12, 1.65)	4,681 (6.3)	**1.01** (0.87 – 1.18)
≥ College	1,414 (4.8)	1.00 (ref)	2,356 (3.2)	1.00 (ref)
Race [b]				
African-American	13,865 (46.9)	**1.78** (1.68, 1.88)	25,529 (34.2)	**2.55** (2.46, 2.65**)**
Hispanic	1,523 (5.2)	1.21 (1.07, 1.38)	4,552 (6.1)	**1.24** (1.15, 1.34)
Other	1,881 (6.4)	1.41 (1.26, 1.58)	4,300 (5.8)	**1.24** (1.15, 1.34)
White	12,307 (41.6)	1.00 (ref)	40,301 (54.0)	1.00 (ref)
Rank [b]				
Junior Enlisted (E1 – E4)	17,355 (58.7)	**5.19** (4.43, 6.08)	28,360 (38.0)	**5.53** (5.19, 5.90)
Mid-level Enlisted (E5 – E6)	10,031 (33.9)	**2.76** (2.35, 3.25)	33,303 (44.6)	**2.79** (2.62, 2.98)
Senior Enlisted (E7 – E9)	2,194 (7.4)	1.00 (ref)	13,020 (17.4)	1.00 (ref)
Years in Service [b]				
≤ 1 Year	2,758 (9.3)	**4.92** (4.12, 5.87)	3,580 (4.8)	**4.08** (3.73, 4.47)
1+ to 2 years	3,415 (11.5)	**6.30** (5.31, 7.48)	5,147 (6.9)	**6.44** (5.96, 6.97)
2+ to 3 years	3,816 (12.9)	**5.95** (5.02, 7.06)	5,628 (7.5)	**5.72** (5.29, 6.18)
3+ to 4 years	3,414 (11.5)	**4.90** (4.12, 5.83)	5,916 (7.9)	**4.77** (4.42, 5.16)

4+ to 5 years	2,801 (9.5)	**4.50** (3.77, 5.37)	5,670 (7.6)	**4.45** (4.12, 4.82)
5+ to 7 years	3,881 (13.1)	**3.96** (3.33, 4.70)	9,980 (13.4)	**4.00** (3.73, 4.29)
7+ to 10 years	3,717 (12.6)	**3.15** (2.64, 3.75)	11,194 (15.0)	**2.93** (2.73, 3.15)
10+ to 15 years	3,551 (12.0)	**2.15** (1.79, 2.57)	13,609 (18.2)	**2.00** (1.87, 2.15)
> 15 years	2,227 (7.53)	1.00 (ref)	13,960 (18.7)	1.00 (ref)
Prior Perpetration History				
Yes	704 (2.4)	**26.83** (24.04, 29.94)	5,028 (6.7)	**67.61** (64.10, 71.31)
No	28,876 (97.6)	1.00 (ref)	69,656 (93.3)	1.00 (ref)
Prior Perpetration Lag Time to Victimization				
No prior perpetration	28,876 (97.6)	1.00 (ref)	69,656 (93.3)	1.00 (ref)
1 – 90 days	111 (0.38)	**8.28** (5.44, 12.60)	819 (1.1)	**17.57** (14.58, 21.19)
91 – 365 days	148 (0.50)	2.28 (1.64, 3.16)	1,066 (1.4)	**5.61** (4.95, 6.35)
1+ year – 3 years	222 (0.75)	2.43 (1.86, 3.17)	1.464 (2.0)	3.72 (3.35, 4.13)
> 3 years	223 (0.75)	**1.08** (0.80, 1.46)	1,679 (2.3)	**2.15** (1.95, 2.38)
Hospitalization in Year Prior to Victimization				
Yes	22,448 (75.9)	**0.81** (0.79, 0.84)	68,959 (92.3)	**1.03** (1.01, 1.06)
No	7,132 (24.1)	1.00 (ref)	5,725 (7.7)	1.00 (ref)
Alcohol Diagnosis in Hospitalization				
Yes	50 (0.17)	1.55 (0.86, 2.78)	322 (0.4)	**1.94** (1.55, 2.42)
No	29,530 (99.8)	1.00 (ref)	74,362 (99.6)	1.00 (ref)
Injury Diagnosis in Hospitalization				
Yes	243 (0.8)	**2.12** (1.64, 2.73)	914 (1.2)	**1.98** (1.73, 2.26)
No	29,337 (99.2)	1.00 (ref)	73,770 (98.8)	1.00 (ref)
Mental Health Diagnosis in Hospitalization				
Yes	385 (1.3)	**1.77** (1.44, 2.18)	573 (0.8)	**2.13** (1.81, 2.52)
No	29,195 (98.7)	1.00 (ref)	74,111 (99.2)	1.00 (ref)
Dual Diagnosis in Hospitalization				
Yes	26 (0.1)	1.33 (0.58, 3.07)	136 (0.2)	**2.11** (1.50, 2.96)
No	29,554 (99.9)	1.00 (ref)	74,548 (99.8)	1.00 (ref)

[a] For women, the average age was 27.3 (SD = 5.9) and the range was 17-55. For men, the average age was 29.4 (SD = 6.5) and the range was 17-65.
[b] Missing data: Age (35 soldiers); Education (879 soldiers); Race (6 soldiers); Rank (1 soldiers).

Table 2. Frequency Distribution and Univariate Logistic Regressions of Psychosocial and Health Behavior Variables by Gender

Risk Factors	Women who took an HRA Survey		Men who took an HRA Survey	
	Frequency N (%) ***N= 7,654***	**Odd Ratio (95% Confidence Interval)**	**Frequency N (%)** ***N= 21,615***	**Odd Ratio (95% Confidence Interval)**
CAGE+2 Alcohol Problems [a]				
≤ 1 Symptom	5,458 (95.7)	1.00 (ref)	15,930 (88.1)	1.00 (ref)
≥ 2 Symptoms	244 (4.3)	1.19 (0.89, 1.59)	2,143 (11.9)	**1.24** (1.12, 1.37)
Drinks per Week [a]				
None	4,893 (64.7)	1.00 (ref)	9,358 (43.9)	1.00 (ref)
1 – 7	2,422 (32.0)	0.97 (0.87, 1.09)	9.265 (43.4)	1.03 (0.96, 1.11)
8 – 14	172 (2.3)	0.81 (0.55, 1.18)	1,825 (8.6)	1.00 (0.89, 1.13)
15 or more	71 (0.9)	1.38 (0.82, 2.30)	882 (4.1)	**1.27** (1.09, 1.48)
Family Problems [a]				
Never/Seldom	5,459 (71.8)	1.00 (ref)	16,325 (76.2)	1.00 (ref)
Sometimes/Often	2,148 (28.2)	**1.78** (1.59, 2.00)	5,098 (23.8)	**1.83** (1.71, 1.96)
Depressed Mood [a]				
Never/Seldom	6,445 (84.8)	1.00 (ref)	19,167 (89.4)	1.00 (ref)
Sometimes/Often	1,156 (15.2)	**1.47** (1.28, 1.69)	2,264 (10.6)	**1.53** (1.39, 1.69)
Social Support [a]				
Always/Sometimes	6,836 (90.9)	1.00 (ref)	19,160 (90.2)	1.00 (ref)
Hardly Ever/Never	682 (9.1)	**1.38** (1.16, 1.64)	2,093 (9.8)	**1.41** (1.27, 1.56)
Work Stress [a]				
Never/Seldom	5,162 (68.6)	1.00 (ref)	15,005 (70.7)	1.00 (ref)
Sometimes/Often	2,364 (31.4)	0.90*(0.80, 1.01)	6,217 (29.3)	1.02 (0.95, 1.10)
Job Satisfaction [a]				
Satisfactory	3,255 (57.1)	1.00 (ref)	10,278 (61.8)	1.00 (ref)
Sometimes/Never	2,446 (42.9)	**1.13** (1.00, 1.29)	6,361 (38.2)	**1.29** (1.20, 1.39)

Interval between HRA and Victimization	*N = 29,580*		*N = 74,684*	
No Prior HRA	21,926 (74.1)	**1.70** (1.49, 1.95)	53,069 (71.1)	**1.62** (1.50, 1.74)
< 1 Year	2,168 (7.3)	**1.93** (1.64, 2.27)	5,456 (7.31)	**1.80** (1.64, 1.97)
1+ – 2 Years	1,728 (5.8)	**1.70** (1.44, 2.02)	4,766 (6.4)	**1.62** (1.47, 1.79)
2+ – 3 Years	1,291 (4.4)	**1.23** (1.01, 1.48)	3,660 (4.9)	1.35 (1.22, 1.50)
3+ – 4 Years	877 (3.0)	1.40 (1.14, 1.72)	2,640 (3.5)	**1.31** (1.17, 1.48)
4+ years	1,590 (5.4)	1.00 (ref)	5,093 (6.8)	1.00 (ref)

*p<0.10

[a] Missing data: CAGE+2 Alcohol Problems (5,494 soldiers); Drinks per Week (381 soldiers); Family Problems (239 soldiers); Depressed Mood (237 soldiers); Social Support (498 soldiers); Work Stress (521 soldiers); Job Satisfaction (6,929 soldiers).

Table 3a. Multivariate Logistic Regression of Alcohol, Psychosocial and Demographic Risk Factors for Spouse Abuse for Women

Women					
Risk Factor	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
CAGE+2 Alcohol Problems					
≤ 1 Symptom	1.00 (ref)		1.00 (ref)	1.00 (ref)	1.00 (ref)
≥ 2 Symptoms	1.19 (0.89, 1.59)		1.18 (0.87, 1.60)	1.05 (0.73, 1.51)	1.16 (0.80, 1.69)
Drinks per Week					
None		1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1 – 7		0.97 (0.87, 1.09)	0.97 (0.85, 1.10)	0.96 (0.82, 1.12)	1.09 (0.93, 1.28)
8 – 14		0.81 (0.55, 1.18)	0.80 (0.54, 1.17)	0.95 (0.61, 1.47)	1.09 (0.69, 1.73)
15 or more		1.38 (0.82, 2.30)	1.29 (0.76, 2.19)	1.29 (0.71, 2.33)	1.26 (0.68, 2.33)
Family problems					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/Often				**1.69** (1.43, 1.99)	**1.73** (1.45, 2.05)
Depressed Mood					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/Often				1.23 (0.99, 1.51)	1.07 (0.86, 1.33)
Social Support					
Always/Sometimes				1.00 (ref)	1.00 (ref)
Hardly Ever/Never				0.94 (0.72, 1.22)	0.92 (0.70, 1.22)
Work Stress					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/Often				**0.82** (0.69, 0.97)	0.91 (0.76, 1.08)
Job Satisfaction					
Satisfactory				1.00 (ref)	1.00 (ref)
Sometimes/Never				1.08 (0.92, 1.27)	0.95 (0.80, 1.13)
HRA Interval					

< 1 year				**1.98** (1.58, 2.49)	**1.29** (1.01, 1.66)
1+ - 2 years				**1.90** (1.49, 2.42)	1.17 (0.90, 1.53)
2+ - 3 years				**1.20** (0.92, 1.58)	0.85 (0.64, 1.13)
3+ - 4 years				1.31 (0.97, 1.77)	0.96 (0.70, 1.33)
> 4 years				1.00 (ref)	1.00 (ref)
Age					
In years, continuous					**1.07** (1.05, 1.09)
Education					
< High School/ GED					1.49 (0.97, 2.29)
Some College					1.34 (0.81, 2.22)
> College					1.00 (ref)
Race					
African-American					**2.04** (1.71, 2.42)
Hispanic					1.51 (1.03, 2.21)
Other					1.39 (1.01, 1.91)
White					1.00 (ref)
Rank					
Junior Enlisted (E1 – E4)					**2.08** (1.36, 3.18)
Mid-level Enlisted (E5 – E6)					1.42 (0.98, 2.08)
Senior Enlisted (E7 – E9)					1.00 (ref)
Prior Perpetration Lag Time to Victimization					
None					1.00 (ref)
1 – 90 days					**5.74** (2.01, 16.39)
91-365 days					1.77 (0.61, 5.09)
1+ year – 3 years					2.87 (1.43, 5.75)
> 3 years					1.02 (0.48, 2.14)
Hospitalization in Year Prior to					

Victimization					
Yes					**1.41** (1.18, 1.69)
No					1.00 (ref)
-2 Log Likelihood (df)	6,169.152 (1)	8,184.023 (3)	6,115.683 (4)	4285.380 (13)	3,942.643 (26)
Δ-2 Log Likelihood			2,068.34 (1)	1,8309.303 (9)	342.74 (13)
p-value Δ			<0.001	<0.001	<0.001

Table 3b. Multivariate Logistic Regression of Alcohol, Psychosocial and Demographic Risk Factors for Spouse Abuse for Men

Men					
Risk Factor	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
CAGE+2 Alcohol Problems					
≤ 1 Symptom	1.00 (ref)		1.00 (ref)	1.00 (ref)	1.00 (ref)
≥ 2 Symptoms	**1.24** (1.12, 1.37)		**1.24** (1.11, 1.38)	1.08 (0.95, 1.23)	1.00 (0.87, 1.14)
Drinks per Week					
None		1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1 – 7		1.03 (0.96, 1.11)	0.98 (0.90, 1.05)	1.02 (0.93, 1.12)	1.03 (0.93, 1.13)
8 – 14		1.00 (0.89, 1.13)	0.92 (0.81, 1.04)	0.98 (0.84, 1.14)	1.04 (0.89, 1.23)
15 or more		**1.27** (1.09, 1.48)	1.12 (0.95, 1.32)	1.05 (0.87, 1.27)	1.00 (0.81, 1.23)
Family problems					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/ Often				**1.81** (1.65, 1.99)	**1.84** (1.66, 2.04)
Depressed Mood					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/ Often				**1.19** (1.05, 1.36)	1.10 (0.95, 1.27)
Social Support					
Always/ Sometimes				1.00 (ref)	1.00 (ref)
Hardly Ever/ Never				**1.23** (1.07, 1.40)	**1.23** (1.06, 1.42)
Work Stress					
Never/Seldom				1.00 (ref)	1.00 (ref)
Sometimes/ Often				**0.85** (0.77, 0.94)	0.92 (0.83, 1.02)
Job Satisfaction					
Satisfactory				1.00 (ref)	1.00 (ref)
Sometimes/ Never				**1.21** (1.11, 1.33)	0.95 (0.86, 1.04)
HRA Interval					
≤ 1 year				**1.78 (**1.58, 2.02)	**1.18** (1.03, 1.36)
1+ - 2 years				**1.67** (1.47, 1.90)	1.17 (1.01, 1.34)
2+ - 3 years				1.33 (1.16, 1.53)	1.00 (0.86, 1.16)

3+ - 4 years				1.39 (1.20, 1.62)	1.11 (0.94, 1.31)
≥ 4 years				1.00 (ref)	1.00 (ref)
Age					
In years, continuous					**1.10** (1.09, 1.12)
Education					
≤ High School/ GED					1.00 (0.74, 1.34)
Some College					**0.78** (0.55, 1.11)
≥ College					1.00 (ref)
Race					
African-American					**3.07** (2.78, 3.38)
Hispanic					1.42 (1.16, 1.73)
Other					1.52 (1.25, 1.85)
White					1.00 (ref)
Rank					
Junior Enlisted (E1 – E4)					**1.72** (1.40, 2.11)
Mid-level Enlisted (E5 – E6)					1.30 (1.11, 1.54)
Senior Enlisted (E7 – E9)					1.00 (ref)
Prior Perpetration Lag Time to Victimization					
None					1.00 (ref)
1 – 90 days					**15.35** (9.47, 24.89)
91-365 days					**5.10** (3.58, 7.26)
1+ year – 3 years					**2.73** (2.10, 3.55)
> 3 years					**2.54** (2.01, 3.21)
Hospitalization in Year Prior to Victimization					
Yes					**1.44** (1.22, 1.69)
No					1.00 (ref)

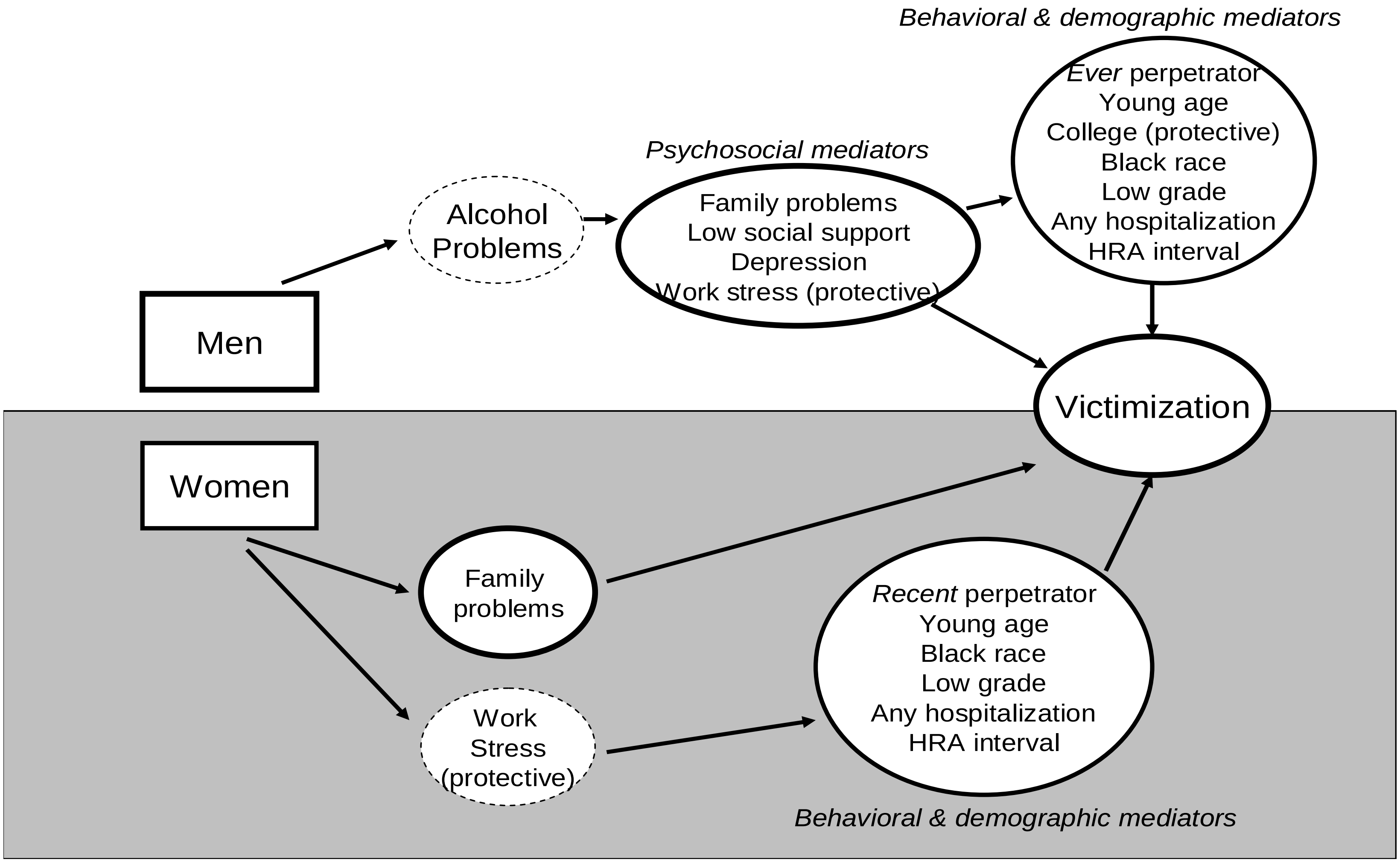
-2 Log Likelihood (df)	19,712.713 (1)	23,152.785 (3)	19,532.890 (4)	14,052.234 (13)	12,171.551 (26)
∆-2 Log Likelihood			3,319.895 (1)	5,480.656 (9)	1,880.683 (13)
p-value ∆			<0.001	<0.001	<0.001

Figure Legends

Figure 1. Gender differences in mediators of spouse victimization. These multivariate models revealed that health behavior risk factors differed somewhat by gender. For men, behavioral and demographic factors mediated the relationship between alcohol problems and victimization. In contrast, the protective effect of work stress for women was mediated by demographic and healthcare utilization factors.

Figure 2. Prior perpetration as a risk factor for spouse victimization. Prior perpetration (*ever)* is a risk factor for men, but for women only if perpetration was within 90 days of victimization.

Figure 1: Gender differences in mediators of spouse victimization



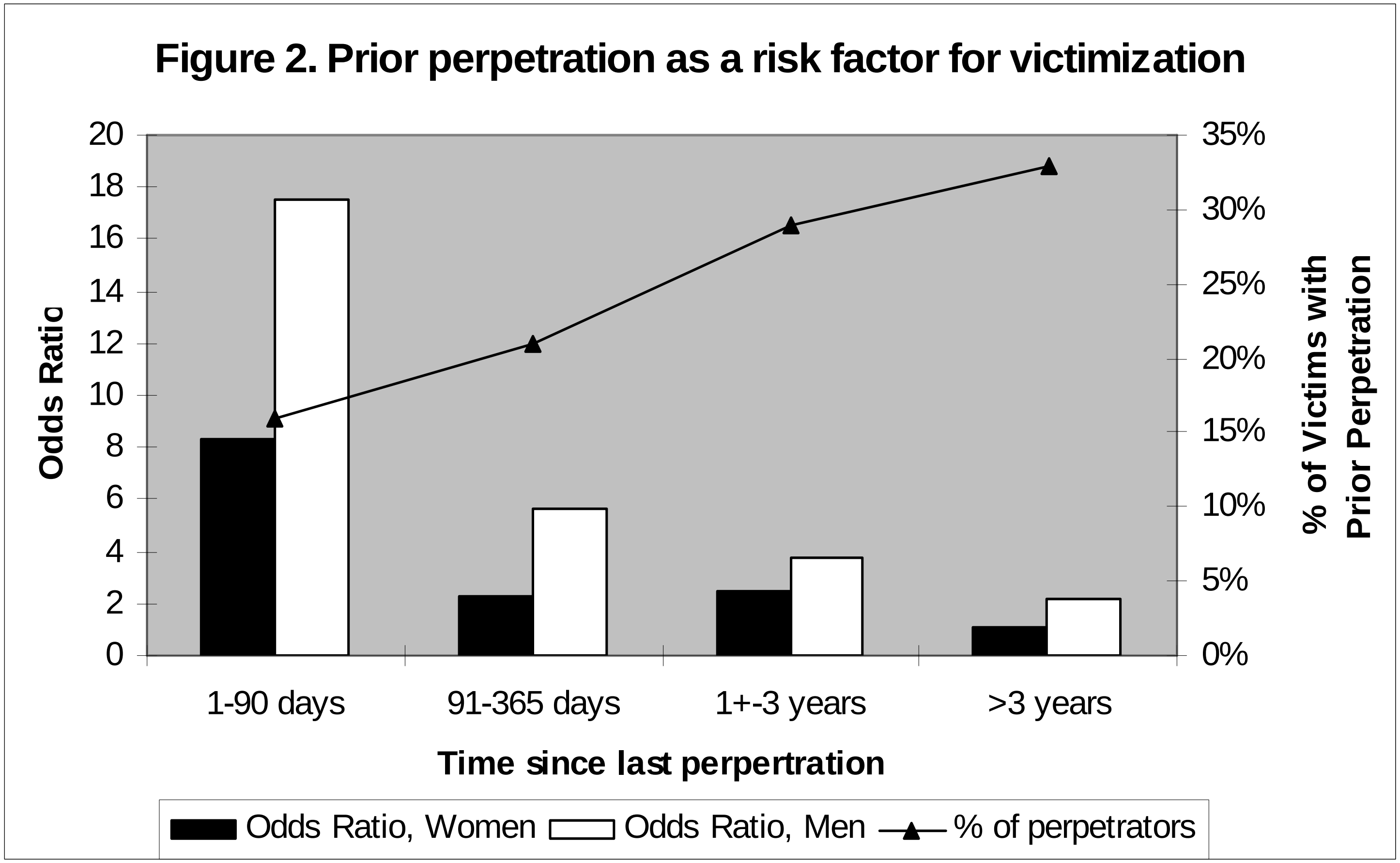


Figure 2. Prior perpetration as a risk factor for victimization
Odds Ratio
20
18
16
14
12
10
8
6
4
2
0
35%
30%
25%
20%
15%
10%
5%
0%
% of Victims with Prior Perpetration
1-90 days
91-365 days
1+-3 years
>3 years
Time since last perpertration
Odds Ratio, Women
Odds Ratio, Men
% of perpetrators

Words in text: 4,898
Words in Abstract: 286
Tables: 3

Health and occupational consequences of spouse abuse victimization among male US Army Soldiers

Nicole S. Bell, ScD, MPH (1)

Author Affiliation and Contact Information:
Social Sectors Development Strategies, Inc.
2330 South Third Street
Tacoma, WA 98433
(253) 302-4770
nbell@ssds.net

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Abstract

Male victims of interpersonal violence are not well studied. While the literature suggests that female victims experience more severe outcomes, relatively little is known about the health and occupational outcomes of male victims. 87,426 male Army soldiers: 11,294 spouse abuse victims with prior spouse abuse perpetration; 3,277 spouse abuse victims with no record of prior perpetration, and 72,855 non-victims were followed for up to twelve years to assess risk for hospitalization and attrition from the Army. In multivariate Cox models controlling for age, race, education, rank, time in service, and number of dependents, victims of spouse abuse were at significantly greater risk for hospitalization and early discharge from the Army than for non-victims. In particular, victims were more likely than nonvictims to experience a hospitalization for depression, alcohol dependence syndrome or other mental health disorders, even when the hospitalization occurred many years after the initial abuse event. Abuse victims who had a prior history of spouse abuse perpetration were at greater risk for both hospitalizations (HR Victim/Perp = 1.45, 95% CI =1.38-1.52, HR Victim/Non-Perp = 1.38, 95% CI = 1.27-1.49) and attrition (HR Victim/Perp = 1.13, 95% CI = 1.08-1.18; HR Victim/Nonperp = 1.05, 95% CI = 1.02-1.08.). In a victim-only model abuse severity and drinking by the female perpetrator or mutual drinking mediated the association between prior perpetrator status and hospitalization and reversed the attrition effect such that male victims who were prior perpetrators were at slightly lower risk than victim-nonperpetrators for early discharge from the Army. College education (two year or more degree) was a protective factor and deserves further inquiry. Male victims need greater support in the time period after an initial episode to reduce their risk for adverse health and occupational outcomes.

Key Words: interpersonal violence, spouse, male, health outcome, army, abuse, victim

Biographies

Nicole S. Bell, ScD, MPH
Nicole Bell is the Vice-president of Social Sectors Development Strategies, Inc. (SSDS). She is the principal investigator for a portfolio of research studies at SSDS, including an NIH funded study of factors that modify the relationship between alcohol use and perpetrating or experiencing family violence or suicide and a DoD sponsored study of alcohol abuse and serious injury among Army soldiers. Her primary research interests are the link between health behaviors, such as alcohol use, and interpersonal violence as well as interactions between health behaviors, demographic characteristics such as gender, age and race/ethnicity, and injuries.

BACKGROUND

The incidence of female-to-male interpersonal violence (IPV) is widely debated. Variations in incidence and prevalence rates appear to depend upon a number of factors including study population characteristics, nature of the relationships (pre marriage, early marriage, cohabitating), and alcohol abuse as well as sampling method characteristics such as violence definition. Studies of incarcerated populations, populations in treatment for couple therapy or substance abuse, or IPV victims reporting crimes or seeking emergency care in shelters will reveal very different perpetrator and victim profiles as well as different indicators of severity and overall incidence.

Data from the Bureau of Justice Statistics and the national Violence Against Women Survey, suggest that women are more likely than men to experience IPV (Tjaden & Thoennes, 2000). Survey instruments measuring violent acts as opposed to outcomes also vary markedly in estimates of the magnitude of the problem. The Conflict Tactics Scale (CTS) is an acts-based measurement tool introduced in 1979 (Langhinrichsen-Rohling, 2005). Use of this and related instruments revealed the unexpected finding that men may be as likely as women to be victims of interpersonal violence (Bohannon, Dosser, & Lindley, 1995; Brush, 1990; Brutz & Ingoldsby, 1984; Burke, Stets, & Pirog-Good, 1988; M.A. Straus & Gelles, 1990). Archer's (2000) meta-analysis of gender differences in aggression suggests that in fact women may be *more* likely to use one or more acts of physical aggression against their intimate partners than men (Archer, 2000). Schafer et al. (1998) estimate that about one-fifth (21.4%) of males are physically abused by female partners compared to 13.6% of women who are reportedly abused by a male intimate partner (Schafer, Caetano, & Clark, 1998). Bookwala et al.'s (1992) research with dating college students found women were more likely than men to report they initiated violence against a nonviolent partner (Bookwala, Frieze, Smith, & Ryan, 1992). Women may not only engage more frequently in IPV but they may abuse more severely. The 1992 National Alcohol and Family Violence Survey findings suggest that 2% of U.S. couples

experience severe male-to-female (M-F) IPV compared to 4.5% of couples who experience severe female-to-male (F-M) severe IPV (Caetano, Ramisetty-Mikler, & Field, 2005; M. A. Straus & Kantor, 1994).

A large portion of IPV cases (48%) are bidirectional with both the male and female members of the couple acknowledging that they had perpetrated IPV, followed by 28% of couples who report violence is unidirectional with females perpetrating and only 23% reporting unidirectional M-F violence. Moreover, recurrence of F-M violence over a five-year follow-up period was more common than M-F recurrence (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005).

Female-related risk factors for F-M abuse include alcohol-related problems (Caetano, Ramisetty-Mikler, & Field, 2005; Cunradi, Caetano, Clark, & Schafer, 1999; Stuart et al., 2006; Stuart, Moore, Ramsey, & Kahler, 2004), heavy alcohol volume (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005), acute intoxication (Caetano, Schafer, & Cunradi, 2001), and observation of parental violence or threat of violence (Caetano, Ramisetty-Mikler, & Field, 2005). Although another study did not find that childhood violence exposure was a significant risk factor for F-M IPV (Chase, O'Farrell, Murphy, Fals-Stewart, & Murphy, 2003). A study by Caetano et al. (2005) found female heavy drinking, female child abuse victimization and couple approval of violence did not significantly predict F-M violence; but, they were risk factors for mutual (bidirectional) violence, as were young age, black race and male alcohol problems (Caetano, Ramisetty-Mikler, & Field, 2005), while another study found incidence of F-M violence to be predicted by female alcohol problems, male observations of parental violence, and male drinking volume (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005). In addition, females who drink more than their male partners appear to be more likely to engage in F-M abuse (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005). Discordant drinking (i.e. only one member of the couple drinking heavily) may be a stronger predictor than drinking partnerships (where both members of the couple drink heavily) (Leadley,

Clark, & Caetano, 2000). However, Lipsky et al.'s (2005) cross-sectional study of women presenting to an emergency room with IPV-related problems revealed that those who were mutually abusive were more likely to report that their partner's drinking behaviors mirrored their own drinking behaviors during the IPV event (Lipsky, Caetano, Field, & Larkin, 2005). In a longitudinal study, White and Chen noted that male drinking strongly predicted F-M violence and that male heavy or problem drinking completely explains (mediates) the initially observed association between female drinking patterns and F-M IPV (White & Chen, 2002).

Race is also a documented risk factor for IPV (Field & Caetano, 2003). Unidirectional F-M and M-F abuse rates are similar for whites, blacks and Hispanics but bidirectional abuse is more common among black couples (Caetano, Ramisetty-Mikler, & Field, 2005). Poverty also appears to be a risk factor for F-M and M-F violence (Cunradi, Caetano, Clark, & Schafer, 2000) as are male unemployment or retirement, male heavy drinking, and male witnessing parental violence as a child (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005). Youth is a risk factor with younger females more likely to perpetrate couple violence (Caetano, McGrath, Ramisetty-Mikler, & Field, 2005).

Relatively little data exists on health and social outcomes experienced by male IPV victims. Evidence indicates that, though incidence of F-M violence may be greater than M-F, the health outcomes, particularly those immediately related to the abuse event (e.g., severe injury, IPV related homicide) are worse for female victims (Cascardi, Langhinrichsen, & Vivian, 1992; Grisso, Schwarz, Miles, & Holmes, 1996; Kellermann & Mercy, 1992; McCarroll, Ursano, Fan, & Newby, 2004; Morse, 1995; Temple, Weston, & Marshall, 2005).

Abuse severity, and therefore possibly long-range health and social outcomes, may depend somewhat upon whether the abuse is uni- or bidirectional, though the mechanism and direction of this association are unclear and inconsistent. Vivian and Langhinrichsen-Rohlings (1994) report violence to be more severe among couples reporting unidirectional abuse than among couples reporting

bidirectional abuse (Vivian & Langhinrichsen-Rohling, 1994). In contrast, Grandin et al. (1998) and Temple et al. (2005) report greater distress among victims of bidirectional abuse than unidirectional abuse victims (Grandin, Lupri, & Brinkerhoff, 1998; Temple, Weston, & Marshall, 2005).

Characteristics of the IPV event itself, such as severity and alcohol abuse, may be linked to both short and long-range health and social effects. For example, female IPV victims are more likely to be injured during IPV events where the abusive partner had been drinking, while female victims' own drinking was not predictive of abuse severity (Thompson & Kingree, 2006).

Men may experience many similar adverse health, social, and occupational outcomes as female IPV victims (Pimlott-Kubiak & Cortina, 2003). Though data on male victims is very limited, studies of male victims indicate that both male and female IPV victims report greater levels of psychological distress than nonvictims (Grandin, Lupri, & Brinkerhoff, 1998). Short-term outcomes from the event itself are likely to include traumatic injury, with the most serious outcome of death. But, studies of female victims also suggest that physical abuse can lead to a wide range of other health problems over a longer period of time, including depression, substance abuse, eating disorders, PTSD and associated post-traumatic immune or endocrine disorders (Acierno, Resnick, & Kilpatrick, 1997; Kilpatrick, Resnick, & Acierno, 1997; Lipsky, Field, Caetano, & Larkin, 2005; Resnick, Acierno, & Kilpatrick, 1997). F-M violence is also associated with increased likelihood of relationship dissolution (Ramisetty-Mikler & Caetano, 2005) which may have indirect social and health effects on male victims as well.

Because there is limited data on long-term health outcomes of male victims it is possible that men may experience different outcomes, some perhaps worse than women. Depression may be a particularly salient issue for male IPV victims (Caetano & Cunradi, 2003). Social stigmatization and real or perceived possible bias in detection, referral and treatment of male victims may also contribute to poorer outcomes (Tjaden & Thoennes, 2000). Men may experience violence for a

longer period of time before seeking care or leaving the relationship. Also, the same factors that may contribute to initial episodes of F-M abuse, such as male unemployment, depression and alcohol abuse, may also affect outcomes for the male victim resulting in greater long-term adverse health and social consequences. Work by Caetano et al. (2001), however, suggests that adverse outcomes experienced by both male and female IPV victims are mostly attributable to the violence itself and not to covarying factors such as drinking-related behaviors (Caetano, Nelson, & Cunradi, 2001).

The goal of this study is to assess long range serious health and occupational outcomes of male victims of physical spouse abuse in the U.S. Army. The Army is a useful study population for this topic because it is a large, predominantly male, diverse, fully employed group, which allows for control of potential confounders that may be present in clinically selected samples or incarcerated populations. In addition, many important risk factors for abuse are more common among Army soldiers including younger age, greater representation of minorities, and higher percentage of risk-behaviors such as heavy drinking (Bray et al., 2003; Fertig & Allen, 1996; Williams, Bell, & Amoroso, 2002). Finally, the availability of complete occupational and health information on such a large cohort is uncommon and a key strength of this study.

We hypothesize that male, active-duty soldiers who have been victims of spouse abuse will be more likely to suffer from adverse health problems, particularly those related to emotional distress and anxiety such as mental health and substance abuse disorders, and poorer occupational outcomes following spouse abuse victimization than male, active-duty soldiers who have never been involved in a documented incident of spouse abuse, either as a victim or a perpetrator. We hypothesize that there will be factors which modify the outcomes for male victims (e.g., occupation, alcohol abuse and other factors that may interact with the experience of being a victim of abuse and affect health outcomes). Because the literature suggests that bidirectional abuse may have different etiology and trajectory than unidirectional abuse, we also hypothesize that adverse outcomes of male victims who

are also reported to be perpetrators of violence will differ from those of male victims who are not reported to be perpetrators, though inconsistencies of findings reported in the literature make it difficult to predict the direction of the association.

MATERIALS AND METHODS

The Data

Data for this study come from the Total Army Injury and Health Outcomes Database (TAIHOD) (Amoroso, Swartz, Hoin, & Yore, 1997; Amoroso, Yore, Weyandt, & Jones, 1999). The TAIHOD is a collection of data files containing demographic and health information on active-duty Army personnel that can be linked through individual identifiers. Portions of the TAIHOD used in this paper include family violence data from the Army Central Registry (ACR), inpatient hospitalization data from the Patient Administration Systems and Biostatistics Activity, and personnel records (demographic, occupational, and discharge information) from the Defense Manpower Data Center. Army policy only recognizes partner abuse incidents between married persons; therefore the ACR contains information about interpersonal violence between partners if they were married at the time of the event. Case reports are investigated by a multidisciplinary committee at the nearest Army medical treatment facility and substantiated cases are recorded in the ACR.

Main Exposure of Interest

Spouse Abuse Victimization. This study defines a spouse abuse victimization event as the first reported and substantiated incident of physical spouse abuse occurring between 1991 and 2000 where a male active-duty soldier was the victim. We examined available ACR data from January of 1970 through December of 1990 and excluded potential cases if they had victimization records prior to the start of the study period since characteristics of repeat spouse abuse victims likely differ from first-time victims. Although the ACR only captures *reported* abuse events and therefore soldiers may

have been victimized by a spouse prior to the first reported event, we felt that excluding cases with prior reported victimizations was a reasonable solution. 14,571 cases (victims) were eligible for inclusion in this study. There may be important differences between male spouse abuse victims who are also accused of perpetrating abuse, so we created two levels of exposure: victims reported in the ACR to have perpetrated spouse abuse ("victim/perpetrators") and victims with no ACR spouse abuse perpetration reports ("victim/non-perpetrators"). For comparison purposes, an unexposed group was also selected. Married, male, enlisted Army soldiers on active duty at any time between 1991 and 2000 with a first report of spouse abuse victimization during that time period were matched in a 1:5 ratio to male, married, enlisted Army soldiers who were never involved in a spouse abuse event, and on active duty at the time of the matched victim's abuse event date. This resulted in a total study population of 87,426.

Outcome Measures

Soldiers were considered to have experienced an adverse health outcome if they were hospitalized, for any reason after the spouse abuse event during the study follow-up period, which ended in September 2002. Attrition was assessed by identifying soldiers discharged from service with an official discharge personnel record at some point during the follow-up period.

Covariates

<u>Demographic Factors</u>. Demographic variables were drawn from Army personnel files and included age, race/ethnicity, number of dependents (children), education, military rank, and total time on active-duty service. Race was coded white, black, Hispanic, or "other." Education was coded as some college (a 2-year degree) or greater versus none. Military rank was grouped according to job seniority and responsibility as follows: junior enlisted (E1-E4), mid-level enlisted (E5-E6), and senior enlisted (E7-E9). Rank may also serve as a proxy for income as studies suggest that poverty is

a risk factor for F-M violence (Cunradi, Caetano, Clark, & Schafer, 2000).. It was also an important control variable in assessing risk for discharge, as were total time on active duty service and age.

Occupational Factors. Since the majority of active-duty spouse abuse victims in the ACR are enlisted we limited our study cohort to enlisted soldiers. The 10 occupational categories reflect those available to enlisted Army soldiers ranging from physically demanding jobs like infantry and mechanical repair to more technically demanding jobs like healthcare and intelligence. We were also able to categorize soldiers based on whether they received hazardous duty pay at any point during follow-up, a possible indicator of risk-taking and sensation seeking personality types.

Abuse-related Factors. The ACR contains self-reported information about the circumstances surrounding abuse events. Our analysis included information on abuse severity (mild, moderate, or severe) and whether the victim, perpetrator or both consumed alcohol prior to the abuse event. Event location (on or off installation) was also included as a be a proxy for social constraints.

ANALYSIS

We used an analytic cohort study design to follow exposed (victims) and unexposed (nonvictims) over time to assess risk for hospitalization or discharge from the Army. Individual variables were examined using frequency distributions and standard descriptive techniques. Follow-up time among active-duty military can vary greatly as soldiers sign on for varying lengths of time; some leave when service obligations are complete, some remain on active duty as until retirement; some may be discharged at any point for personal reasons or because of Army needs (i.e. military downsizing, soldier performance or other problems). Due to the dynamic nature of the cohort, we used standard time-to-event statistical methods (Kaplan-Meier estimates of survival distributions, log-rank tests, and Cox proportional hazards models) to analyze the data. Time to outcome of interest was calculated from the first spouse abuse victimization occurrence (or the matched event for unexposed soldiers) until the soldier experienced an inpatient hospitalization, or was censored (left

the Army or the follow-up period ended in 2002). When a soldier experienced multiple hospitalizations subsequent to the spouse abuse victimization, the first hospitalization was used for analysis. Risk for early discharge from the Army was assessed in similar models where the outcome was discharge and covariates included age, rank, length of service, and occupation.

We began by exploring possible univariate associations between individual characteristics and inpatient hospitalizations or early discharges, using univariate Cox proportional hazards models with likelihood ratio tests and by viewing Kaplan Meier curves. We tested several hypothesized interactions including race*exposure status (unidirectional abuse versus prior perpetration history), education*exposure status and alcohol use during the event*exposure status. All analyses were conducted in SAS version 8.1 ("SAS", 2000) and adhere to the policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

RESULTS

The total study population consisted of 87,426 soldiers: 11,294 spouse abuse victim/perpetrators; 3,277 s victim/non-perpetrators, and 72,855 non-victims. Mean age at the start of each soldier’s follow-up time for the total study population was 29.7 years (SD=6.5) versus 26.5 years (SD=5.2) for victim/perpetrators , 27.5 years (SD=5.5) for victim/non-perpetrators, and 30.3 years (SD=6.6) for non-victims. Mean time in service at the start of follow-up for the total study population was 109.9 months (SD= 73.3) versus 75.9 months (SD=56.4) for victim/perpetrators , 85.5 months (SD=61.2) for victim/non-perpetrators , and 116.3 months (SD=74.5) for non-victims. At the start of follow-up, spouse abuse victims were significantly more likely to be young, of minority race, have less than a college education, and have no dependents. Non-victims were significantly more likely to have had more than 5 years in service, be of higher ranks, and have received hazardous duty pay (data not shown).

Adverse Health Outcomes

A total of 14,963 soldiers (17.12% of the study population) experienced a hospitalization during the follow-up period; 21.13% of victim/perpetrators, 19.93% of victim/non-perpetrators , and 16.37% of non-victims. Median length of follow-up for the total study population was 742.02 days (SD=714.5) from the time of spouse abuse victimization (or matched event date) to hospitalization. For victim/perpetrators, median time to hospitalization was 661.13 days (SD=702.5) compared to 702.4 days (SD=748.3) for non- perpetrating victims, and 760.37 days (SD=713.8) for non-victims. The shorter length of time between initial entry to cohort and hospitalization is not attributable to hospitalizations related to the actual abuse event since 0.62% of the hospitalizations occurred within a week of the spouse abuse event and only one-quarter of events occurred within the first year following the spouse abuse event date (data not shown).

The most common diagnoses among nonvictims were treatment for an old disruptive anterior cruciate ligament, unilateral inguinal hernia, lumbar disc displacement, sterilization and acute appendicitis. In contrast, victims were more likely to be hospitalized with mental health or substance abuse treatment disorders: victim/perpetrator top diagnoses included brief depressive reaction, adjustment reactive-emotional/conduct disorder, acute appendicitis, alcohol dependence and victim/non-perpetrator top diagnoses were brief depressive reaction, alcohol dependence, old disruptive anterior cruciate ligament, unilateral inguinal hernia, adjustment reaction/emotional/ conduct disorder, and alcohol dependence (data not shown).

Table 1 provides results from univariate Cox proportional hazards models showing unadjusted associations between individual characteristics (victimization status, demographic and occupational factors) and hospitalization risk. Spouse abuse victims were significantly more likely to be hospitalized during the follow-up period compared to soldiers never involved in a spouse abuse event. Victim/perpetrators were at slightly greater risk for subsequent hospitalization than victim/non-perpetrators (HR=1.41, 95% CI=1.35-1.47 versus 1.35, 95% CI= .25-1.46, respectively).

In addition, older age, no college degree, higher rank, larger families, white race, not receiving hazardous duty pay, and shorter time on active duty were also risk factors. Infantry/gun crews and healthcare workers were at greater risk for hospitalization (Table 1).

(INSERT TABLE 1 HERE)

Controlling for demographic and occupational characteristics only slightly attenuated the effect of spouse abuse victimization on hospitalization risk. Victim/perpetrators are still at highest risk with a HR of 1.45 (95% CI=1.38-1.52) followed by victim/non-perpetrators with a HR of 1.38 (95% CI=1.27-1.49) (see Table 2). Other factors identified in univariate analyses remained significant in the full model. We tested for an interaction between exposure status and education. While the HR for victim/perpetrators with less than a college education was greater than for victim/perpetrators with some college education it was not statistically significant and thus was not retained in the multivariate model.

(INSERT TABLE 2 HERE)

To assess abuse event-related factors a victim-only subanalysis was run. In unadjusted analyses event factors associated with increased victim hospitalization risk included victim drinking during the abuse event, perpetrator and victim mutual drinking, location of event with those occurring off installation associated with greater likelihood of subsequent hospitalization, and abuse events with severe injury. In multivariate models none of the event-level variables were significant predictors of subsequent hospitalization risk among victims. Though HRs were similar to those noted in prior models with the full population, few (only race and education) remained statistically significant in victim-only subanalyses. Black, Hispanic and “other” racial/ethnic groups were all at significantly lower risk for hospitalization than were white spouse abuse victims. Having at least a two-year college degree was protective against future hospitalization among spouse abuse victims (HR for less than a two-year college degree = 1.25, (95% CI=1.02-1.53). Victim’s perpetrator status was not associated with a statistically significant increased risk for subsequent serious health problems once

other factors were in the full model. In particular, inclusion of abuse severity and drinking, particularly victim drinking and mutual drinking, during the abuse event attenuated the influence of exposure status (no difference among victim/perpetrators and victim/non-perpetrators).

Spouse Abuse and the Length of Army Service

57,524 out of 87,426 in the total study population (65.8%) were discharged from the Army between the abuse event date and the end of the follow-up period; 69.5% of spouse abuse victims/perpetrators, 63.3% of victim/non-perpetrators, and 65.3% of nonvictims. Mean time from abuse event date to discharge was 39.6 months overall, but 29.0 for victim/perpetrators, 27.7 months for victim/non-perpetrators, and 32.2 months for non-victims.

In unadjusted models, spouse abuse victims were significantly more likely to have shorter time on active duty compared to soldiers never involved in a spouse abuse event: Risk for early discharge was similar for victims who were and were not perpetrators (HR=1.13, 95% CI=1.10-1.15; and HR=1.18, 95% CI=1.13-1.24, respectively). Age was bimodally related to discharge risk such that those age 25 or younger and those over age 35 were more likely to be discharged during the follow up period. Other factors associated with increased likelihood of discharge during follow up include less than college education, fewer dependents, white race, longer time on active duty and certain occupations such as mechanical equipment repair and nonocccupational category (generally reserved for soldiers in a special status position such as going to school or serving as recruiter). Rank, like age, was bimodally distributed (data not shown).

After controlling for demographic and occupational characteristics, victims are still significantly more likely to have a shorter time on active duty than soldiers never involved in a spouse abuse event. The HR for victim/perpetrators was unchanged by the addition of covariates. But, the HR for victim/non-perpetrators was attenuated by the addition of covariates dropping from

1.18 to 1.05 (95% CI=1.02-1.08) (see Table 3). In this multivariate model age and rank are no longer bimodally related to discharge risk. Lower-ranked victims are at greater risk for discharge once age and total time in service are controlled. Controlling for rank revealed higher risk for discharge among older soldiers. Other independent risk factors for early discharge include less than a college education, white race, hazardous duty pay receipt and longer time in active-duty service.

(INSERT TABLE 3 HERE)

In victim-only subanalyses the only event-related factor predictive of early discharge for the spouse abuse victim was perpetrator drinking during the event. Compared to neither party drinking during the event, risk for early discharge was slightly higher (HR=1.13, 95% CI=1.01-1.27) when the perpetrator had been drinking during the abuse event. Risk was also elevated when both were drinking during the event but did not achieve statistical significance (HR=1.06, 95% CI= 0.99-1.13). Victim-only drinking was unrelated to the outcome (HR=1.00). In addition, in the full model victim/perpetrators were at significantly LOWER risk for discharge than victim/non-perpetrators (victim/perpetrator HR=0.92, 95% CI=0.87-0.97). Younger age, black race (compared to white) and less total time in active service was protective against discharge. All age groups under 40 were significantly less likely to be discharged. Once age and total time in service were controlled, lower rank was associated with increased likelihood of discharge (data not shown).

DISCUSSION

Health and occupational consequences for male IPV victims have not been well established. Data from this study indicate that male victims are at increased risk for future serious health problems (hospitalizations). Very long lag time between the initial spouse abuse event and hospitalization date suggest that these hospitalizations are unrelated to the initial spouse abuse incident. They may be due to injury experienced after another (recurrent) spouse abuse episode. But, the diagnostic distribution (more mental health than injuries) suggests rather that they are more likely the indirect long-term

outcomes of IPV victimization OR the factors that covary with IPV victimization. Depression and other mental health diagnoses as well as alcohol dependence syndrome were among the more common hospital diagnoses for male IPV victims, whereas hernias knee and back injuries were the most common diagnoses among non-victims hospitalized during the follow-up period. Victims were at increased risk for hospitalizations occurring five or more years after the initial IPV event date. This suggests that either the IPV is ongoing or factors related to the initial abuse event persist, or that the health consequences of the initial act of violence persist. Regardless, male victims are in need of more support services and research is needed to better understand the persistence of this association.

In general, our data suggest that male victims who were also perpetrators were at greater risk for adverse outcomes than were male victims-only. Male victim/perpetrators had greater risk for both hospitalization and discharge from the Army in multivariate models. This finding is somewhat supported by Temple et al.'s study which found that in mutually-abusive relationships where the female was the primary perpetrator, the violence perpetrated was more severe than in relationships where the female was the only perpetrator or cases in which abuse was more symmetrical (Temple, Weston, & Marshall, 2005). Thus, our victim/perpetrators may be at greater risk for adverse health outcomes because their spouse is a primary perpetrator but not unidirectionally abusive.

It is noteworthy that the association between prior perpetrator status and adverse outcomes is completely mediated by the inclusion of event-related factors. In the victim-only model inclusion of event-level factors, such as perpetrator drinking, mutual drinking during the event, and severity, victims/perpetrators were no longer at greater risk than victim/non-perpetrators. In addition, victim/perpetrators were at significantly lower risk for attrition than victim/non-perpetrators.

The protective effect of education against future hospitalizations for victims was notable. Also, though not significant, there was evidence of a possible exposure*education interaction such that less than a college degree was associated with an increased risk for hospitalization among

victims. These findings suggest that education should be considered as a potential intervention tool for male victims of spouse abuse. Mutual drinking or drinking by the female perpetrator is also an important factor and potential indicator of adverse outcomes for the male victim.

Limitations

This study uses only “reported” cases of spouse abuse. They are identified through a process of self-referrals, referrals from commanders, neighbors, clergy, and police intervention. It is likely that this process does not result in uniform identification of all abuse cases. In addition, unlike action-based assessments such as the CTS, this study relied on a victim reporting registry. Thus, rates are lower than population-based registries. Still, the demographic profile of the population is similar to that reported in other population-based studies. As with other studies, we also find that male victims tend to be younger, of minority race, have less than a college education, no children, and are of lower occupational rank than non-victims. Though te high percentage of co-abuse is similar to that reported in the literature, it is unclear from the data who initiated the abuse.

Strengths

A key strength of this study is the quality and breadth of the data available. It is unusual, if not unique, to study such a large occupational cohort of male victims and to also have data on their demographic characteristics, abuse event factors, such as drinking, and to be able to follow them for hospitalization and discharge histories. Also, individually-linked data with a long follow up allows for a more accurate assessment of hospitalization risk, following a family violence incident. The cohort study design allows for study of causal order – first victimization and subsequent adverse health and occupational consequences – which is a notable advantage over cross-sectional study designs. Finally, the study population is a high-functioning group, whereas some studies rely upon couples in therapy, incarcerated individuals or those undergoing treatment for substance abuse or in medical care facilities. Some potential confounders, such as access to healthcare and employment,

are controlled for by design. Individual variation in related factors, such as income, is largely controlled by analysis with covariates such as rank and occupation.

In conclusion, male victims are at significantly greater risk for future hospitalizations related to depression, alcohol abuse and other mental health disorders and the effects of victimization persists over a long period of time. More research is needed to clarify whether this is due to recurrent victimization or persistence of either negative consequences from the initial event or factors associated with the initial event. Similarly, male victims are more likely to be discharged from the Army earlier than their peers of the same rank and time in service. The etiology of this finding is not clear but warrants further investigation. Potential protective effects of college education are also worthy of further study.

TABLES AND FIGURES

Table 1. Unadjusted associations between individual characteristics and subsequent hospitalization, univariate Cox proportional hazard models.

Characteristic		Hazard Ratios	95% Confidence Intervals
Main exposure	Spouse abuse victim		
	Victim and Perpetrator	1.41	1.35-1.47
	Victim and not Perpetrator	1.35	1.25-1.46
	Not victim or Perpetrator	1.00	Ref
Demographic	Age		
	18-20	0.93	0.84-1.02
	21-25	0.89	0.85-0.93
	26-30	0.79	0.75-0.83
	31-55	0.83	0.79-0.87
	36+	1.00	Ref
	Education		
	Non-College	1.12	1.07-1.18
	College	1.00	Ref
	Rank		
	E1-E4	1.07	1.02-1.12
	E5-E6	0.91	0.88-0.96
	E7-E9	1.00	Ref
	Number dependents		
	Zero to One	0.88	0.83-0.92
	Two	0.91	0.87-0.96
	Three	0.92	0.87-0.96
	Four or more	1.00	Ref
	Race/Ethnicity		
	White	1.00	Ref
	Black	0.94	0.90-0.97
	Hispanic	0.94	0.88-1.00
	Other	0.87	0.81-0.93
Occupational	Enlisted MOS		
	Infantry/Gun Crews	1.00	Ref
	Healthcare	1.24	1.16-1.31
	Electronic Equipment Repair	0.89	0.82-0.96
	Communications/Intelligence	0.99	0.94-1.05
	Technical/Allied Specialists	0.93	0.85-1.02
	Support/Administration	0.91	0.86-0.96
	Mechanical Equipment Repair	0.99	0.94-1.04
	Craftsworkers	1.02	0.91-1.15
	Service/Supply	0.98	0.93-1.04
	Nonoccupational	0.61	0.36-1.05
	Hazardous duty pay		
	Yes	0.89	0.86-0.92
	No	!.00	Ref

	Time on active duty		
	Less than 2 years	1.17	1.11-1.24
	2-5 years	1.08	1.03-1.12
	> 5 years	1.00	Ref

Table 2. Risk factors for hospitalization after controlling for demographic and occupational characteristics

Characteristic		Hazard Ratios	95% Confidence Intervals
Main Exposure	Spouse abuse victim		
	Yes (and perp)	1.45	1.38-1.52
	Yes (not perp)	1.38	1.27-1.49
	No	1.00	Ref
Demographic	Age		
	18-20	0.62	0.55-0.70
	21-25	0.67	0.63-0.72
	26-30	0.69	0.65-0.73
	31-55	0.78	0.74-0.82
	36+	1.00	Ref
	Education		
	Non-College	1.19	1.12-1.26
	Some College or greater	1.00	Ref
	Rank		
	E1-E4	1.21	1.12-1.31
	E5-E6	1.04	0.99-1.10
	E7-E9	1.00	Ref
	Number dependents		
	Zero to One	0.89	0.84-0.94
	Two	0.93	0.88-0.98
	Three	0.93	0.89-0.98
	Four or more	1.00	Ref
	Race/Ethnicity		
	White	1.00	Ref
	Black	0.88	0.85-0.92
	Hispanic	0.89	0.83-0.95
	Other	0.84	0.78-0.90
Occupation	Enlisted MOS		
	Infantry/Gun Crews	1.00	Ref
	Healthcare	1.23	1.15-1.30
	Electronic Equipment Repair	0.89	0.82-0.96
	Communications/Intelligence	1.01	0.95-1.07
	Technical/Allied Specialists	0.95	0.87-1.05
	Support/Administration	0.91	0.86-0.96
	Mechanical Equipment Repair	0.99	0.94-1.04
	Craftsworkers	1.01	0.95 –1.07
	Service/Supply	0.98	0.93-1.04
	Nonoccupational	0.58	0.32-1.04
	Hazardous duty pay		
	Yes	0.92	0.89-0.95
	No	1.00	Ref
	Time on active duty		
	Less than 2 years	1.12	1.03-1.23

	2-5 years > 5 years	1.03 1.00	0.97-1.10 Ref

* p values
Missing data:

Table 3. Risk factors for discharge from the Army after controlling for demographic and occupational characteristics

Characteristic		Hazard Ratios	95 % Confidence Intervals
Main Exposure	Spouse abuse victim		
	Yes (and perp)	1.13	1.08-1.18
	Yes (not perp)	1.05	1.02-1.08
	No	1.00	Ref
Demographic	Age		
	18-20	0.73	0.69-0.77
	21-25	0.74	0.72-0.77
	26-30	0.71	0.69-0.74
	31-35	0.57	0.56-0.59
	36+	Ref	
	Education		
	Non-College	1.11	1.08-1.14
	Some College or greater	1.00	Ref
	Rank		
	E1-E4	2.01	1.93-2.10
	E5-E6	1.08	1.05-1.10
	E7-E9	1.00	Ref
	Number dependents		
	Zero to One	1.00	0.98-1.03
	Two	1.00	0.98-1.03
	Three	0.95	0.93-0.98
	Four or more	1.00	Ref
	Race/Ethnicity		
	White	1.00	Ref
	Black	0.94	0.92-0.96
	Hispanic	0.92	0.89-0.95
	Other	0.96	0.93-1.00
Occupation	Enlisted MOS		
	Infantry/Gun Crews	1.00	Ref
	Healthcare	0.96	0.93-0.99
	Electronic Equipment Repair	1.01	0.97-1.05
	Communications/Intelligence	0.98	0.95-1.01
	Technical/Allied Specialists	0.98	0.93-1.03
	Support/Administration	0.98	0.95-1.00
	Mechanical Equipment Repair	102	0.99-1.06
	Craftsworkers	1.03	0.97-1.06
	Service/Supply	1.03	1.00-1.06
	Nonoccupational	1.10	0.88-1.38
	Hazardous duty pay		
	Yes	1.03	1.01-1.05
	No	1.00	Ref
	Time on active duty		
	Less than 2 years	0.64	0.61-0.66

	2-5 years	0.80	0.77-0.83
	> 5 years	1.00	Ref

* p values
Missing data:

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Intentional injury victims and perpetrators in the U.S. Army: variations in the pathway to violence

Nicole S. Bell, ScD, MPH (1) and Thomas C. Harford, PhD, MA (2)

Author Affiliations:
1. Social Sectors Development Strategies, Inc. Tacoma, WA
2. Boston University School of Public Health, Boston, MA

Abstract

Objective: describe and compare demographics, prior health and behavioral characteristics of perpetrators and victims of self-inflicted and non-self inflicted intentional injuries

Design: Case-control

Setting: U.S. Army soldiers on active duty between 1971 and 2005

Subjects: Cases (N= 92,139) were all active duty soldiers with an intentional injury. Soldiers on active duty at the time of the case injury but who had no recorded intentional injury incidents were eligible to be controls (N = 184,278).

Outcome Measures: Suicide, hospitalization for non-fatal self-inflicted injury; record of perpetrating spouse or child abuse; homicide, assault-related injury hospitalization, or record of spouse abuse victimization.

Results: Multinomial logistic regression models revealed that male gender was positively associated with suicide, spouse abuse perpetration and assault victimization and female gender was associated with for non-fatal self-inflicted injury, and child abuse perpetration. Age was inversely related to all intentional injury outcomes except completed suicide (age directly related to suicide) and not related to homicide. Total time-in-service and occupational rank were inversely related to risk for self-inflicted injury, spouse or child abuse perpetration, assault and spouse abuse victimization. Minority soldiers were at greater risk for all outcomes other than self-inflicted injuries. College education was protective for ALL intentional injury outcomes. Alcohol dependence (CAGE) was weakly related to spouse abuse perpetration but no other outcome. In contrast, heavy drinking (measured prior to, and independent of, the

intentional injury event) was positively associated with increased risk for self-inflicted fatal and nonfatal injury, spouse abuse perpetration and assault. Drinking and driving was also related to assault. Self-reported frequent depression, wanting to hurt oneself, considering suicide, and family problems were all related to non-fatal self-inflicted injury. Of these, only reporting ever having considered suicide was associated with suicide. Prior hospitalization for mental health, alcohol or injury were all strongly associated with increased risk for ALL of the intentional injury outcomes.

Conclusions: Implications for policy and prevention include the need for better follow-up of hospitalized patients with an alcohol, mental health or injury diagnosis. The protective effect of education warrants further exploration as a potential intervention tool.

Key Words: intentional, assault, homicide, suicide, spouse abuse, army

Introduction

The term “intentional injury” encompasses a wide range of outcomes including suicide, attempted suicide, assault, including that which occurs in domestic relationships - interpersonal violence (IPV) which, at its worst form, may result in homicide. Intentional injury also covers aggressive acts and perpetration of violence. Because of the volitional nature of intentional injuries they are often reported on and studied separately from unintentional injuries.

As a group, intentional injuries are a significant cause of death in the U.S. In 2003 the CDC reported 17,096 assault-related deaths and 30,642 suicides with associated age-adjusted rates of 5.8 and 10.5 per 100,000 (respectively) (41). Among 15-24 year olds homicides and suicides combined are the second leading cause of death and they are the third leading cause of death among 25-44 year olds.

Non-lethal assault and self-inflicted injury is harder to assess because of lack of data on cause and intent. Hospital discharge surveillance systems generally report nature and not cause of injuries. The National Electronic Injury Surveillance System (NEISS) sampling of emergency departments in the U.S. began collecting data on injury causes in 2000 within a subgroup of the hospitals sampled (2). In 2000 there were approximately 1,984,000 emergency room visits for intentional injury (or about 6.4% of the total injuries treated in emergency rooms). Most of these were assaults (5.5%) followed by self-inflicted (0.7%) and a small percent (0.2%) resulted during the course of legal intervention. Men were generally at greater risk for assault-related injuries, with the exception of sexual assault and women were generally at greater risk for injury resulting from self-harm (2).

Data on intimate partner violence (IPV) rates vary substantially depending in large part upon the definition of violence and population surveyed and whether the focus is on outcomes of violence or violent actions per se. The vast majority of instances of IPV are not reported to the police and underreporting is associated with gender (men more likely to underreport) and the nature of the attack (sexual, physical, emotional) (73). It is estimated that over 5 million women and 3 million men are victims of IPV each year (73). Over a lifetime, nearly a third of women (29%) and over 1/5th of men (22%) report experiencing some form of IPV (30). Some studies suggest that the rate of female to male perpetration of violence may be higher than male to female IPV (9, 24, 25, 64, 70).

Recent data indicate that violent crimes have increased over the past year (32). This is an alarming trend as the etiology for this increase is not clear. Though often considered as a broad group, intentional injury outcomes likely reflect different etiologic pathways. While certain demographic or individual personality factors may be similar for some of these outcomes, it seems likely that there are important factors which may modify whether violence is turned inward on oneself, outward on others or whether one becomes a victim of violence.

Risk factors for these outcomes are not generally studied all at once in a single population but are rather singled out for study using one specific population focusing on one or two selected intentional injury outcomes at a time. Results from some of these studies of individual types of intentional injury have identified gender, race, age, lower educational attainment, economic status/unemployment, mental health disorders, substance abuse, and personality factors including impulsivity, aggression, low self-

esteem, anger and hostility. The direction of these associations varies by type of outcome, study design, study population and measurement approach. For example, the association between gender and risk for assault depends upon whether assault is defined by an outcome or by a behavior. Men are at greater risk than women for an assault-related injury by a stranger but women are far more likely than men to experience an assault-related injury or to be killed by their intimate partners (28, 46, 60, 72). In contrast, measures of acts of violence per se suggest that men are as or more likely than women to experience violence perpetrated against them by their female partners (9, 17, 21, 22, 64, 69).

Completed suicides are more common among men but suicidal ideation (nonfatal self-inflicted injury) is more common among women. Most military suicides are among young enlisted males (17-24 years of age) (39). A study of U.S. Marines suggests, however, that female active duty personnel may be at particular risk for suicide when compared to similar civilians (40).

Race is also an important risk factor with African Americans generally at greater risk for all intentional with the exception of those that are self-inflicted. Rates for suicide and self-inflicted nonfatal injuries are lower for blacks than whites. However, among younger people, there has been an increase in suicides with the greatest increase among nonwhite, particularly black, males (4, 18, 78). In addition, the U.S. Marine study suggests that Hispanics in the military may be more prone to suicide than their civilian peers (40). Suicide rates in the Army have risen in recent years (11).

Suicidal ideation is more common among younger people while completed suicide rates increase with age (16, 47, 61). Rich et al. reported that suicides for those

under 30 years of age were more often associated with antisocial personality disorders and substances abuse, whereas among the elderly, suicide is associated with affective disorders and organic brain syndrome (62). Others have indicated higher proportions of character disorders among younger versus older suicides and suicide attempts (55). Suicidal ideation and prior attempts are among the strongest predictors of completed suicide for all age groups. In addition, major depression and alcohol abuse have been found to be important risk factors for suicide (37).

Investigations of problem behaviors among adolescents have revealed a "problem behavior syndrome" in which a number of health risks and problem behaviors cluster together (33). For example, alcohol use has been found to be associated with suicidal inclinations (36), risky sexual behavior (38, 54), and aggression, violence, and other physically harmful behavior (34, 74). Problem behavior theory postulates that these behaviors are manifestations of an underlying syndrome of unconventionality or proneness toward deviance. Sosin et al. in an analysis of the 1990 Youth Risk Behavior Survey, revealed significant relationships between physical fights (i.e., being in a fight during the preceding 30 days in which at least one participant was injured and had to be treated by a doctor or a nurse) and other problems behaviors, including suicide attempts, carrying firearms, cocaine use, drunk driving, multiple sex partners, and condom nonuse (68)

Studies of risk factors and patterns of risk for suicide and homicide suggest a common source of pathogenesis for both outcomes (52, 53). Alcohol misuse is a particularly important risk factor in that it may be modified, can often be identified prior to an intentional injury event and thus serve as an early indicator for interventionists

before violence occurs, and because it interacts with other risk factors that may not by themselves lead to violence but which may, when coupled with alcohol, lead a person to harm themselves or others, whether intentionally or unintentionally. Alcohol use has also been linked to perpetration of family violence (12, 13, 26, 48, 71, 75) as well as spouse abuse victimization (31, 45, 51, 71, 75). There may be common threads that link both interpersonal violence and suicidal behavior with alcohol use, suggesting a need for a more inclusive conceptual approach to these behaviors. What is not clear is what distinguishes between assaults against self versus assaults against others. In addition, the possible divergence of risk factors or pathways with increasing age needs to be evaluated.

The goal of this study is to use a very large occupational cohort, the U.S. Army, to compare a wide range of intentional injury outcomes, reaching back in time to explore patterns of prior healthcare utilization, as well as assessing demographic and self-reported health-related behaviors in order to better understand the similarities and differences in the causal pathways that ultimately lead to some form of intentional injury. Assessing risk factors for a wide range of intentional injury outcomes within the context of one population allows for the control of many potential confounders by design: All subjects have equal access to health care, they are employed and relatively high functioning, as opposed to studies of incarcerated or treatment populations or unemployed individuals. While occupational experiences can vary dramatically among members of the armed forces, there are common experiences and risks such as deployment, requirements to maintain a healthy weight and to pass physical fitness testing annually (1, 44, 63). A better understanding of these risk factors may help

improve screening and detection of risk factors for specific types of intentional injury. In addition, the unique stressors related to military life, including deployment, dual military couples, and frequent moves add another dimension to the risk factors faced by our active duty forces.

Methods

Data

Data for this study come from the Total Army Injury and Health Outcomes Database (TAIHOD) (7, 8). The TAIHOD is a relational database that links health and administrative datasets for active duty Army personnel. Portions of the TAIHOD used in this paper include the Child and Spouse Abuse Registry System, referred to as the Army Central Registry (ACR), Army Casualty (death) files, hospital data from the Army Individual Patient Data System, personnel records (demographic and discharge information) from the Defense Manpower Data Center (DMDC), and health behavior data from Army Health Risk Appraisal (HRA) surveys. Data on soldiers who left the Army prior to their death were not available for analysis, although those which occur within 120 days post discharge are included in the Army files.

The Army Health Risk Appraisal (HRA), a self-administered survey offered routinely, although not universally, to soldiers in the 1990s as part of the Army's Health and Wellness program (66) provided data on typical alcohol consumption patterns, alcohol-related problems and other psychosocial risk factors. Analysis of responses to the HRA alcohol items suggests that they are valid and reliable (14, 15, 66). HRAs were completed prior to and independent of the abuse event. When soldiers had

completed more than one HRA, the HRA taken closest, and prior, to the intentional injury incident date was used.

Selection of Cases and Controls

All active duty soldiers with a substantiated case for one or more of the outcomes of interest comprised the cases for this study. Soldiers who were on active duty at the time of the case outcome but who had no recorded intentional injury incidents were eligible to be controls and were matched at the point in time when demographic data were collected. There were a total of 92,139 single event cases with 184,278 controls. Cases were further randomly assigned to two sub-groups for the purpose of cross-validation.

Outcome Measures

Seven measures of intentional injury were considered for these analyses grouped as intentional self-inflicted injuries (suicide, self-inflicted intentional injury hospitalizations); intentional injury to others (spouse abuse perpetrator, child abuse perpetrator), and victim of intentional injury (hospitalized victim of assault, homicide victim, spouse abuse victim)

Injury to Self:

Suicides: Death records, inpatient hospital records and emergency room deaths were used to locate completed suicides. Death records include information on manner of death including whether or not the death was determined to have been caused by suicide. Hospital records for active-duty soldiers are created in the PASBA hospitalization files when they are treated in either military or civilian facilities. They

receive a primary diagnosis and up to 7 secondary diagnoses for a given hospitalization. Diagnoses are recorded according to the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM). Injury diagnoses receive additional codes that indicate cause and place of occurrence using the NATO Standardized Agreement 2050 (referred to as the STANAG) (5, 6). Unlike civilian cause coding (E-codes), the STANAG tends to be very complete and uses two separate variables, the “trauma” and the “injury” codes, to capture information on both intent and proximal cause.

Suicides were identified through review of both the death records and hospital records. This was important as some individuals were treated in the emergency ward or hospitalized to treat injuries related to suicide but nonetheless died. Suicide records were available for the years 1980-2003 with a few cases found in 2004 and 2005.

Non-fatal Self-Inflicted Injury Hospitalizations: Non-fatal self-inflicted injuries were identified by review of STANAG codes for all injury hospitalization records. All injury hospitalizations with intentional STANAG Trauma code = 4 (self-inflicted) AND with disposition not equal to death were coded as non-fatal self-inflicted injury. Non-fatal suicide hospitalization cases were available from 1980 through 2005.

Injury to Others:

Spouse or Child Abuse Perpetrator: Spouse and child abuse perpetrators were identified through the ACR records. Army policy recognizes incidents of partner violence between married persons only. Child abuse perpetrators may or may not be married. Case reports are investigated by a multidisciplinary committee at the nearest Army medical treatment facility and substantiated abuse events are recorded in the

ACR. TAIHOD data include ACR records for substantiated cases of abuse occurring between 1971 and June 2003. We used the incident date from the ACR to match eligible controls to spouse and child abuse perpetrators.

Intentional Injury Victim:

Non-Fatal Assault-Related Hospitalization: Assault-related nonfatal injuries were identified through review of hospital records. Hospital assaults are defined using STANAG codes. For this analysis, soldiers with a STANAG Trauma code 3 (intentional, inflicted by others) were included. We also included those with an Injury code of 97* (fighting) so long as Trauma code is not equal to 0, 1, 2, or 4. Battle-related trauma (Trauma = 0, 1), trauma resulting from legal intervention (Trauma = 2), and self-inflicted trauma (Trauma = 4) were excluded. Only the first assault-related hospitalization for a soldier following an HRA survey was analyzed.

Homicide: Homicide victims were identified in the same way as suicide victims were identified. We reviewed death records as well as inpatient hospitalization records. Intentional injury assaults resulting in death were coded homicide.

Spouse abuse victimization: Spouse abuse victimization was identified through review of the ACR files in the same manner in which spouse abuse perpetrators were identified (see above).

Other Measures

Demographic variables were drawn from Army personnel files and included gender, age at time of incident, race/ethnicity, education, military rank, number of years in service, number of months in rank, and number of dependents. Gender was defined

as male compared to female and dummy variables were constructed for age categories (less than 21 years, 21-25 years, 26-30 years, 31-35 years, 36-40 years with 41 years or more as referent), race/ethnicity (black, Hispanic, Native American/Alaskan, Asian/Pacific Islander, other with white as referent), education (some college, Bachelor's degree or higher with high school diploma or equivalent as referent). Military rank was grouped according to level of seniority, leadership and responsibility as follows: E1-E4 junior enlisted rank, E5-E6 junior noncommissioned officers, and E7-E9 senior noncommissioned officers. Time in service was categorized as less than 2 years, 2 to 5 years, 5 or more to 10 years, with more than 10 years as referent. Marital status was defined by married, previously married with never married as referent. Number of dependents was defined as 3, 4, or 5 or more with service member or spouse as referent. DMDC data indicating receipt of special hazardous duty pay within the past 12 months was also included as an indicator of high risk-taking behaviors as well as potential job stress (67, 76) and was coded as follows: hazardous pay for parachute, other hazardous pay with no hazardous pay in the past year as referent.

Information related to alcohol dependence and typical alcohol consumption patterns prior to the incident date were available for subjects who had completed a HRA. The CAGE, a well-validated and frequently used four-item screening tool that appears on the HRA, was used to determine alcohol dependence (23, 56). In addition to the standard CAGE items, two dichotomous questions indicative of alcohol-related problems were also included from the HRA; "Do your friends ever worry about your drinking?" and "Have you ever had a drinking problem?" Subjects with two or more positive responses to these six questions were classified as alcohol-dependent. Usual

drinking behaviors were measured using self-reported number of drinks in a typical week, coding the weekly alcohol consumption responses into the following categories: none, 1-7 drinks, 8-14 drinks, 15-21 drinks, and > 22 drinks per week (27). Responses to the modified CAGE and questions about alcohol consumption patterns have been shown to be reliable and to have good predictive validity (15, 35).

Other HRA items included in the analyses were measures of family problems, social support, work stress, job satisfaction, depressive symptoms, including prolonged feelings of depression and suicide ideation, and serious personal loss in the past year. Other HRA variables included health habits (exercise, eating and sleeping habits), and high-risk behaviors (smoking, seat belt usage, speeding). Time between completion of the HRA and the outcome date was also included in the model in order to assess the influence of the proximity of HRA measures.

We also reviewed hospital records prior to the incident date for cases and controls. Time between discharge from the closest prior hospitalization and the outcome date was also included in the model in order to assess the influence of the proximity of the diagnosis on risk for subsequent outcome. We included mental-health related hospitalizations occurring prior to the outcome event (ICD-9 codes 290-315). Each ICD-9-CM code was based on first appearance in the list of 8 possible diagnoses for each hospitalization. Two variables were constructed including alcohol-related diagnoses (ICD-9 291, 303, 305A, 571, and 980) and all other mental health disorders. Injury cause codes were obtained from the STANAG system for coding causes and intent. A dummy variable was constructed indicating whether or not the primary diagnosis was injury, excluding injuries resulting from physical training, and those that

were battle-related or the result of legal intervention as these injuries were not hypothesized to be related to any underlying behaviors or personality factors that would predispose the soldier to risk of a future intentional injury event.

Analytic Approach

Multinomial logistic regression analyses were conducted to examine the associations between demographic characteristics and type of prior hospitalization for each of the intentional injury outcomes with control as the referent category. This analysis was based on those respondents with a single outcome event (n = 276,417; cases = 92,139 and control = 184,278). A similar analysis was conducted for those respondents who completed an HRA questionnaire (n = 37,496; cases = 12,141 and controls = 25,355). In view of the large number of HRA variables, this analysis was conducted in two stages. In the first stage, we conducted the multinomial logistic regression analyses for all demographic, hospitalization, and HRA variables. In the second stage we excluded all non-significant variables. Analyses were conducted in SAS, version 8.2 (3). All analyses for this project adhere to the policies for the protection of human subjects as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

Results

Analysis among the two random sub-samples of cases yielded comparable results and the findings from the total sample are presented here. To conserve space we report findings just for the combined groups.

There were 276,417 study subjects of which 184,278 were controls. Among the 92,139 cases there were 1,646 suicides (0.6% of total) and13,247 hospitalized victims of personally-inflicted injury (4.79%); 24,546 spouse abuse perpetrators (8.88%) and 22,667 child abuse perpetrators (8.20%), and 17,981 hospitalized victims of assault (6.51%), 682 homicide (0.25%) victims and 11,370 spouse abuse victims (4.11%). Table 1 shows the demographic breakdown of the study population by outcome group. The most common outcome available for study were injuries inflicted on others, specifically spouse and child abuse (N = 47,213) followed by assault-related injury victimization events (N = 30,033) and then self-inflicted injuries (N = 14,893).

{INSERT TABLE 1 HERE}

Table 2 displays results from multinomial regression models for each outcome. Demographic factors and prior hospitalization histories associated with each outcome are compared to matched controls.

Injury to self: male gender was associated with increased risk for suicide but they were at lower risk than women for non-fatal self-inflicted injury. Age was not related to suicide but younger age was a risk factor for non-fatal self-inflicted injury. Similarly, lower rank and shorter time in service were also risk factors for non-fatal self-inflicted injury but not for completed suicide. Blacks and Hispanics were at lower risk for both suicide and suicide attempts than whites. Married and previously married individuals were also at greater risk for self-inflicted injury as were soldiers with more dependents (children). Number of dependents was not related to completed suicide.

Receipt of special pay for hazardous duty exposures and college education were protective for both suicide attempt and completed suicide (Table 2).

Injury to others: male gender was positively associated with spouse abuse perpetrator but females were at greater risk for child abuse perpetrator. Younger age, shorter time in service, and lower rank were also risk factor for spouse and child abuse perpetrator, as were marital status and larger families (more than 3 dependents). Minority race was associated with an increased risk for perpetration of spouse abuse (increased risk among black, Hispanic, Asian and Native Americans compared to white). Black soldiers were at greater risk than white soldiers for child abuse perpetration while Hispanics were less likely than whites to be child abuse perpetrators. Receipt of hazardous duty pay was associated with increased risk for spouse abuse perpetration. College education (two year degree or more) was protective reducing risk for both spouse and child abuse perpetration (Table 2).

Intentional Injury Victim: male gender was associated with increased risk for assault victimization. But female gender was associated with spouse abuse victimization. Gender was not related to homicide. Soldiers under age 40 were at greater risk for all intentional injury victimization outcomes and soldiers of lower rank (E1-E4) or with shorter time in service (less than 10 years) were at risk for assault-related hospitalizations. Black race was associated with increased risk for IPV (spouse abuse victimization) and greater risk for homicide, but lower risk for non-fatal assault-related hospitalizations than white soldiers (referent). Hispanic and Asian soldiers were also less likely to experience non-fatal assault hospitalizations but Native Americans were at greater risk. Marriage was protective for assault. Though it was positively

associated with spouse abuse this may be largely due to Army case definition for spouse abuse. Greater number of children was associated with increased risk for spouse abuse victimization but was unrelated to homicide. Receipt of hazardous duty pay for parachute exposure was associated with increased risk for IPV (spouse abuse victimization) but lower risk for assault-related hospitalization and homicide. College education was protective against both assault-related hospitalizations and homicide (Table 2).

Prior Hospitalizations: Prior hospitalizations for alcohol abuse, other mental disorders or for a prior injury were associated with all of the intentional injury outcomes with the sole exception of homicide. Mental health prior hospitalizations are particularly potent predictors of self-inflicted non-fatal and fatal injury. But all three types of prior hospitalizations (mental health, alcohol and prior injury) are significant predictors of subsequent intentional injury outcomes (Table 2).

{INSERT TABLE 2 HERE}

There were 37,496 cases and controls who completed an HRA (12,141 cases and 25,355 controls). Among the cases there were 190 suicides (0.51% of total) and 730 hospitalized victims of personally-inflicted injury (1.95%); 4,757 spouse abuse perpetrators (12.69%) and 2,959 child abuse perpetrators (7.89%); and 68 homicide (0.18%) victims, 677 hospitalized victims of assault (1.81%), and 2,760 spouse abuse victims (7.36%). HRA risk factors associated with each outcome are shown in Table 3.

{INSERT TABLE 3 HERE}

The results from the multinomial logistic regression for each outcome among soldiers with a completed HRA, compared with controls, are shown in Table 4. Some factors were no longer significant in the HRA subpopulation analysis and were excluded from the models. Of the factors that remained in the model the direction of the associations were similar to those observed in the full population model (table 2), though many were somewhat attenuated by the introduction of health behavior and psychosocial variables from the HRA. Education was again protective for spouse and child abuse perpetration, and assault and spouse abuse victimization. Lower rank was associated with increased risk for all outcomes except completed suicide. Younger age (under 40) was also associated with increased risk for all family violence outcomes (spouse abuse perpetrator, child abuse perpetrator and spouse abuse victim) but not associated with the other outcomes. Shorter time in service was also related to self-inflicted nonfatal injury, spouse abuse perpetration and spouse abuse victimization but not child abuse perpetration, assault or homicide. Larger family size (more dependents) was associated with increased risk for all family violence indicators (spouse abuse and child abuse perpetration and spouse abuse victimization), and for self-inflicted non-fatal injury. But, family size was protective for completed suicide. Black race was associated with increased risk for spouse and child abuse perpetration, homicide, hospital assault and spouse abuse victimization but, again, lower risk for suicide attempt. Hazardous duty pay was protective against all self-inflicted injury outcomes and injury to other outcomes. But, receipt of special pay for parachute-related hazardous duty exposure was related to increased risk for assault-related hospitalization.

Though somewhat attenuated by inclusion of the HRA items, prior alcohol-related hospitalization is still significantly associated with all outcomes with the exception of homicide. Similarly, mental health-related hospitalizations were still very strongly related to suicide attempt or completion as well as spouse abuse perpetration and assault-related hospitalization.

Of the HRA alcohol-related items, the CAGE was associated with a small, but significant increased risk for spouse abuse perpetration but not child abuse. It was not related to any other intentional injury outcome. Heavy alcohol volume (weekly drinking) was associated with increased risk for spouse abuse perpetration but not child abuse perpetration (there was a noteworthy significant protective effect for light drinkers as compared to abstainers). Homicide and non-fatal assault risk was also associated with alcohol volume, but spouse abuse victimization was not. Smoking was associated with increased risk for suicide, attempted suicide, spouse abuse perpetration, child abuse perpetration and assault-related hospitalization. Associations were strongest for current, followed by former smokers compared to nonsmokers (table 4). Seatbelt use was linearly and inversely related to spouse abuse perpetration and assault-related hospitalization as well as spouse abuse victimization. As expected, suicidal ideation was associated with both completed suicide and suicide attempts. Affirming that he/s had sometimes or often considered hurting him/herself, often or sometimes and reporting feeling depressed or often/sometimes as well as reporting sometimes or often having family problems were all associated with suicide attempt but not completed suicide. Self-reported family problems are also predictive of spouse abuse and child abuse perpetration and spouse abuse victimization but not homicide or assault. Work

stress is protective against hospital-related assaults and spouse abuse victimization. Aerobic exercise also is protective against spouse abuse victimization. Time between HRA and event was not associated with any of the outcomes.

INSERT TABLE 4 HERE

Discussion

Risk factors for a wide range of intentional injury outcomes are provided together here and suggest important variations between subgroups at risk. Risk factors for intentional injury vary across not only the entire range of intentional injury outcomes studied but even within more specific classifications of intentional injury. Risk factors for self-inflicted injury, in particular, depend primarily on whether or not the soldier completed suicide or was instead injured during a non-fatal self-inflicted injury event. It is impossible with these data to uncover the actual intent and thus to know if the individual truly intended to kill him or herself or was making a gesture to seek help for a situation that felt desperate in some way.

Some of these findings hint at possible variations in etiological pathways for violence and potential intervention strategies worth considering. The apparent protective effect of receipt of hazardous duty pay and work stress for most outcomes is intriguing. One might expect that highly hazardous, demanding jobs would increase the likelihood of expressing anger, frustration or aggressive behaviors in response to these sort of stressors. The unexpected protective effect may, instead, be a proxy for the presence of social supports of some form. Or, they may also reflect higher levels of job

satisfaction and thus be a latent measure of self-esteem. Finally, it may be that demanding jobs occupy the soldier more and provide fewer opportunities for getting into trouble.

Social support was not significantly protective for any intentional injury outcome, with the exception of child abuse perpetration, once other factors were in the model. Child abuse perpetrators were also more likely to be female, young, of lower rank, black race or Native American. This finding may suggest a need for greater support programs for the young, working moms, particularly those of minority racial/ethnic backgrounds and in lower occupational ranks.

Also of possible relevance are studies linking serotonin, aggression, and suicide. Lower levels of serotonin 5-HIAA (5-Hydroxyindoleacetic acid) have been associated with impulsive and violent suicide attempts (10). Linnoila et al. found lower levels in violent offenders whose crimes were unpremeditated (50). Branchey et al. found lower levels in alcoholics arrested for assaultive behavior compared to alcoholic controls (20). The fact that 5-HIAA is associated with violence directed against both self and others directs attention to the role of situational factors associated with impulsive suicide. These findings suggest that aerobic exercise could be protective as studies show exercise increases the level of 5-HIAA as well as serotonin and other mood-enhancing markers (29). Our data was inconclusive for most outcomes but did find a significant, protective effect for aerobic exercise and spouse abuse victimization.

Alcohol use patterns appear to be important predictors of intentional injury in this population but associations vary with type of alcohol abuse. Symptoms of alcohol dependence (CAGE), for example, seem to be unrelated or only very weakly related to

intentional injury risk. On the other hand, weekly heavy drinking is strongly associated with most of the intentional injury outcomes. Heavier drinking is associated with increased risk for suicide, self-inflicted nonfatal injury, spouse abuse perpetration, and hospitalization for assault. It does not appear to be related to child abuse perpetration or spouse abuse victimization in this population. These latter outcomes are more common among women suggesting that heavy drinking may be a better indicator of adverse intentional injury outcomes for men than for women.

The consistent and strong association between prior hospitalizations for mental health problems, alcohol problems, or injury hospitalizations with ALL intentional injury outcomes is noteworthy and suggests a possible need for improved follow up of patients with these diagnoses. This may be particularly true for patients who are treated for their injuries or acute intoxication events in the emergency department and then released without a good follow-up plan to address the underlying risk factors which contributed to the event in the first place.

The association between health behaviors such as low seatbelt usage, smoking, and drinking and driving may suggest an underlying mental health disorder such as depression or low self-esteem. Speeding, smoking and other risk-taking personality traits have been linked to risk of alcohol abuse (77) (19, 57, 59). Liang et al. (1999) found seatbelt non-use to be clustered with drinking among young men and found associations between drinking and driving among females (49), while Hunter et al. (2000) found lowered seat belt use to be a risk factor for frequent alcohol intoxication among Air Force recruits (42). Moreover, Hurst et al. (1997) found correlations between low self-esteem and smoking, substance use, seatbelt use and exposure to dangerous

situations (43). Other studies have found low self-esteem and powerlessness to be associated with alcohol consumption (58, 65)

Limitations and Study Strengths

Because the sample is outcome- and not actions-based and does not contain all acts of violence, in particular acts of violence against others, the findings must be interpreted with some caution. Similarly, the findings should not be misunderstood to reflect actual underlying incidence or prevalence rates of intentional injury behaviors among Army soldiers. Rather, it is an event-based analysis of serious intentional injuries that have been identified through various legal, medical and social support systems.

A key strength of this study is the ability to study and describe all of these intentional injury outcomes at one time and with one, large, diverse group of people. Extensive information on prior health status, demographics and health behaviors is a unique strength as is the ability to identify and follow individuals over time with very complete data on long-range intentional injury outcomes.

Implications for Prevention

The persistent protective effect of education across most of the intentional injury outcomes deserves further study. Our study design does not allow us to assess causal order between education and improved health outcomes. Future studies and perhaps pilot tested interventions should investigate the potential utility of offering college education and training to soldiers who may otherwise be at increased risk for serious intentional injury outcomes. Hospitalization for injury, mental health disorders or

alcohol-related problems should result in a thorough screening for other risk factors for intentional injury outcomes. Long-term follow-up to prevent or reduce risk factors for intentional injury should be arranged before discharge from the emergency department or the inpatient facility. Patients reporting heavy drinking patterns should raise a warning flag for clinicians to engage in a more thorough search for the presence of other risk factors for intentional injury, particularly among male patients. Female patients reporting low social support, low seatbelt usage and family problems should be screened for family violence.

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Tables and Figures

Table 1. Distributions of demographic characteristic and prior hospitalization by intentional injury outcomes. (n=276,417).

	Injury to Self N = 14,893		**Injury to Others N = 47,213**		**Intentional Injury Victim N = 30,033**			**Controls N = 184,278**	**Totals**
Risk factors	Suicide N=1646	Suicide Attempt N=13247	Spouse Abuse Perpetrator N=24546	Child Abuse Perpetrator N=22667	Homicide N=682	Assault Hospital N=17981	Spouse Abuse Victim N=11370	Controls N=184278	**N =276417**
	%	%	%	%	%	%	%	%	%
Gender									
Women	4.50	23.74	3.04	13.80	15.25	3.96	52.82	15.10	15.10
Men	95.50	76.26	96.96	86.20	84.75	96.04	47.18	84.90	84.90
# missing	0	0	0	0	0	0	0	0	0
Age									
<21	18.38	43.58	8.79	5.91	20.59	36.65	9.54	17.97	18.27
21-25	36.87	37.27	45.26	30.95	41.76	45.65	44.90	33.87	36.07
24-30	18.77	11.48	25.18	28.09	20.44	11.49	25.65	19.41	20.00
31-35	12.61	4.96	12.60	20.02	8.38	4.01	12.83	13.18	12.67
36-40	7.86	1.97	6.17	11.62	6.32	1.67	5.53	9.39	8.25
>40	4.51	0.73	1.99	3.41	2.50	0.50	1.55	6.17	4.74
# missing	5	47	14	31	2	29	5	348	476
Race/Ethnicity									
White	70.93	71.81	41.51	56.30	48.53	67.23	40.11	63.87	60.89
Black	18.40	19.24	47.60	34.66	43.26	24.09	48.73	26.47	29.43
Hispanic	5.61	4.86	5.81	4.34	4.11	4.20	5.25	4.83	4.86
Native American/Alaskan	0.79	0.84	0.76	0.69	0.73	0.94	0.90	0.69	0.66
Asian/Pac Islander	1.95	1.25	1.48	1.58	1.03	1.04	2.00	1.94	1.78
Other	2.32	1.99	2.85	2.44	2.35	2.50	3.02	2.30	2.39
# missing	5	7	8	993	0	14	5	2141	3168
Education									
High School									

(equiv) or less	86.41	94.33	93.95	88.02	90.61	95.23	90.71	76.17	82.70
Some college	6.26	3.39	3.30	7.61	4.77	3.09	4.59	6.54	5.86
College or greater	7.33	2.28	2.75	4.38	4.62	1.67	4.70	15.29	11.24
# missing	49	304	190	1144	11	102	163	5097	7015
Rank									
E1-E4	56.87	86.21	58.45	47.00	63.49	84.73	63.26	51.97	55.94
E5-E6	26.12	10.94	33.61	42.45	24.93	12.49	28.98	24.69	25.67
E7-E9	10.02	1.62	5.79	10.65	7.62	1.56	4.56	9.10	7.90
Officer/Warrant	6.98	1.23	2.15	3.90	3.96	1.23	3.20	14.48	10.49
# missing	0	1	0	1	0	1	0	5	8
Time in active Service									
<2	30.01	62.82	18.25	11.97	32.99	51.35	23.15	27.48	28.55
2-5	27.95	22.52	35.31	25.48	30.79	33.30	36.69	28.95	28.95
>5-10	20.53	9.59	27.13	29.69	18.91	10.74	24.86	20.05	20.05
>10 years	21.51	5.07	19.31	32.86	17.30	4.62	15.29	22.44	22.44
# missing	0	0	0	983	0	3	0	1972	2958
Marital Status									
Single	50.12	64.90	16.79	11.81	52.75	72.26	14.72	44.28	40.87
Married	46.61	32.77	81.75	84.38	45.17	26.28	83.75	52.55	56.24
Divorced/Widowed/ Separated	3.26	2.33	1.46	3.81	2.08	1.46	2.21	3.18	2.88
# missing	22	206	624	384	9	127	212	2424	4008
Dependents									
Member or spouse	67.50	79.96	43.94	22.37	69.33	83.30	51.45	63.17	59.89
3	12.91	10.34	24.99	22.49	13.48	8.81	22.44	14.34	15.71
4	11.79	6.58	18.97	28.20	12.89	5.46	17.56	14.03	14.80
5 or more	7.79	3.11	12.10	26.95	4.30	2.43	8.54	8.46	9.59
# missing	43	360	437	1335	7	194	247	5748	8398
Hazardous Duty Pay 1 year prior event									
None (past year)	96.16	94.89	88.70	91.96	94.28	90.80	92.33	87.53	88.78
Parachute and other	2.26	4.78	10.08	6.08	5.13	8.33	6.27	9.71	8.89
Other hazard pay	1.58	1.29	1.93	8.49	0.59	0.87	1.40	2.76	2.33
# missing	0	0	0	0	0	0	0	0	0

Hospital 1 year prior to event									
Alcohol									
No	95.20	95.95	97.90	98.39	98.68	98.40	99.10	99.19	98.76
Yes	4.80	4.05	2.10	1.61	1.32	1.89	0.90	0.81	1.24
Mental Health									
No	91.98	89.33	97.03	97.69	97.51	98.30	99.58	98.90	98.03
Yes	8.02	10.67	2.97	2.31	2.49	1.70	2.42	1.01	1.97
Injury									
No	87.42	93.76	93.54	94.68	91.94	93.35	93.08	95.79	95.20
Yes	12.58	6.24	6.46	5.32	8.06	6.65	6.92	4.21	4.80

*Individuals with only one outcome are counted for each event.

Table 2. Demographic and prior hospitalization risk factors from multivariable logistic regression models of each intentional injury outcome compared to controls (n=276,417).

	Injury to Self N = 14,893		Injury to Others N = 47,213		Intentional Injury Victim N = 30,033		
Risk factors	Suicide	Suicide Attempt	Spouse Abuse Perpetrator	Child Abuse Perpetrator	Homicide	Assault Hospital	Spouse Abuse Victim
	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Gender							
Women	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Men	3.71*(2.91-4.72)	0.65*(2.91-4.72)	6.26 (5.92-6.93)	0.75*(0.72-0.79)	1.13 (0.91-1.41)	4.60*(4.26-4.98)	0.16*(0.15-0.17)
Age							
<21	0.87 (0.59-1.28)	2.35*(1.82-3.03)	1.70*(1.49-1.95)	2.13*(1.87-2.42)	1.76 (0.88-3.51)	2.43*(1.89-3.13)	1.80*(1.47-2.21)
21-25	0.98 (0.68-1.41)	1.77*(1.37-2.27)	2.49*(2.20-2.82)	2.67*(2.40-2.97)	2.15+(1.01-4.13)	2.42*(1.89-3.10)	2.50*(2.17-3.02)
24-30	0.99 (0.71-1.39)	1.50*(1.17-1.92)	2.01*(1.28-2.59)	2/35*(2.13-2.59)	2.11*(1.11-4.13)	2.03*(1.59-2593)	2.15*(1.79-2.58)
31-35	1.10 (0.82-1.47)	1.39*(1.10-1.77)	1.69*(1.51-1.88)	1.99*(1.83-2.18)	1.18 (0.66-2.10)	1.73*(1.37-2.20)	1.89*(1.58-2.25)
36-40	0.96 (0.71-1.29)	1.13 (0.88-1.44)	1.39*(1.24-1.55)	1.66*(1.52-1.82)	1.32 (0.75-2.33)	1.46*(1.14-1.86)	1.51*(1.26-1.81)
>40	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Race/Ethnicity							
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Black	0.65*(0.57-0.74)	0.63*(0.60-0.66)	2.75*(2.66-2.84)	1.17*(1.13-1.21)	2.01*(1.70-2.37)	0.95*(0.91-0.98)	2.10*(2.00-2.20)
Hispanic	1.06 (0.85-1.32)	0.80*(0.73-0.88)	1.60*(1.49-1.70)	0.79*(0.77-0.83)	1.09 (0.74-1.62)	0.81*(0.75-0.88)	1.38*(1.25-1.52)
Native American/Alaskan	1.19 (0.67-2.12)	0.92 (0.74-1.15)	2.06*(1.23-2.46)	1.13 (0.92-1.37)	1.58 (0.65-3.83)	2.42*(1.19-1.69)	1.61*(1.25-2.04)
Asian/Pac Islander	0.97 (0.67-1.40)	0.66*(0.51-0.71)	1.36*(1.21-1.54)	0.89 (0.79-1.01)	0.66 (0.30-1.49)	0.60*(0.51-0.70)	1.40*(1.20-1.64)
Other	0.90 (0.64-1.25)	0.78*(0.68-0.90)	1.74*(1.59-1.90)	0.93 (0.84-1.03)	1.39 (0.84-2.29)	1.11+(1.01-1.23)	1.70*(1.50-1.93)
Education							
High School (equiv) or less	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Some college	0.97 (0.78-1.21)	0.88+(0.79-0.98)	0.54*(0.50-0.58)	0.91*(0.86-0.97)	0.80 (0.55-1.15)	0.87+(0.80-0.96)	0.65*(0.59-0.72)

College or greater	0.59*(0.42-0.83)	0.58*(0.49-0.68)	0.47*(0.42-0.53)	0.50*(0.45-0.55)	0.43*(0.23-0.82)	0.37*(0.31-0.44)	0.61*(0.57-0.70)
Rank							
E1-E4	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E5-E6	1.10 (0.92-1.32)	0.67*(0.61-0.73)	0.62*(0.59-0.65)	0.71*(0.67-0.79)	1.05 (0.79-1.38)	0.70*(0.66-0.75)	0.66*(0.62-0.71)
E7-E9	1.36+(1.02-1.81)	0.40*(0.33-0.49)	0.38*(0.35-0.41)	0.45*(0.42-0.49)	1.40 (0.87-2.26)	0.49*(0.41-0.58)	0.44*(0.39-0.51)
Officer/Warrant	0.82 (0.55-1.22)	0.19*(0.15-0.24)	0.21*(0.18-0.24)	0.26*(0.23-0.30)	0.81 (0.42-1.78)	0.30*(0.24-0.37)	0.27*(0.23-0.32)
Time in active Service							
<2	1.34+(1.00-1.83)	3.83*(3.29-4.46)	1.10+(1.01-1.19)	0.73* (0.66-0.79)	1.04 (0.71-1.84)	2.74*(2.40-3.12)	1.33*(1.18-1.49)
2-5	1.15 (0.87-1.53)	1.64*(1.42-1.91)	1.24*(1.15-1.37)	0.98 (0.92-1.06)	0.95 (0.61-1.48)	1.96*(1.73-2.23)	1.36*(1.23-1.51)
>5-10	1.30+(1.04-1.64)	1.45*(1.27-1.65)	1.14*(1.07-1.21)	1.06*(1.00-1.17)	0.92 (0.64-1.33)	1.55*(1.38-1.74)	1.18*(1.08-1.29)
>10 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Marital Status							
Single	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Married	0.85+(0.73-0.99)	1.06+(1.00-1.12)	5.70*(5.45-5.97)	2.53*(2.38-2.68)	0.89 (0.71-1.11)	0.63*(0.60-0.66)	6.60*(6.18-7.04)
Divorced/Widowed/ Separated	0.99 (0.73-1.35)	1.17+(1.02-1.34)	2.54*(2.25-2.87)	3.55*(3.23-3.90)	0.68 (0.39-1.20)	0.78*(0.68-0.89)	2.04*(1.76-2.37)
Dependents							
Member or spouse	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.87 (0.73-1.05)	1.21*(1.12-1.31)	1.21*(1.16-1.26)	3.18*(3.02-3.35)	1.03 (0.78-1.35)	1.10*(1.03-1.18)	1.29*(1.21-1.37)
4	0.83 (0.80-1.01)	1.29*(1.17-1.41)	1.26*(1.20-1.32)	5.31*(5.03-5.60)	1.15 (0.85-1.55)	1.09+(1.01-1.19)	1.53*(1.43-1.64)
5 or more	0.87 (0.68-1.10)	1.56*(1.37-1.76)	1.61*(1.51-1.70)	9.69*(9.26-9.99)	0.61+(0.39-0.95)	1.09 (0.97-1.23)	1.78*(1.62-1.94)
Hazardous Duty Pay 1 year prior event							
None (past year)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Parachute and other	0.68*(0.56-0.82)	0.52*(0.48-0.57)	1.12*(1.06-1.18)	0.76*(0.72-0.81)	0.54*(0.36-0.76)	0.77*(0721-0.81)	1.26*(1.16-1.38)

Other hazard pay	0.45*(0.29-0.71)	0.34*(0.27-0.43)	0.92 (0.53-1.03)	0.76*(0.67-0.85)	0.28*(0.11-0.76)	0.42*(0.35-0.49)	0.91 (0.76-1.09)
Hospital 1 year prior to event							
Alcohol							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.65*(2.02-3.45)	2.56*(2.32-3.03)	1.82*(1.61-2.05)	1.46*(1.28-1.66)	1.28 (0.64-2.55)	2.34*(2.05-2.56)	1.26*(1.00-2.09)
Mental Health							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	5.30*(4.27-6.58)	9.11*(8.36-9.93)	2.48*(2.34-2.75)	1.74*(1.55-1.95)	1.99*(1.18-3.35)	1.32*(1.15-1.52)	1.80*(1.55-2.08)
Injury							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.84*(2.43-3.32)	1.78*(1.63-1.94)	1.38*(1.30-1.47)	1.14*(1.06-1.22)	2.11*(1.59-2.81)	1.88*(1.76-2.01)	1.19*(1.07-1.33)

* p < .01 +p < .05.

Table 3. Distributions of HRA items by 7 outcomes. (n=37,496).

	Injury to Self = N = 920		**Injury to others N = 7716**		**Victim Intentional Injury N = 3505**			**Control N = 25355**	**Total**
Risk factors	Suicide N=190	Suicide Attempt N=730	Spouse Abuse Perpetrator N=4757	Child Abuse Perpetrator N=2959	Homicide N=68	Assault Hospital N=677	Spouse Abuse Victim N=2760	Control N=25355	**N =37496**
	%	%	%	%	%	%	%	%	
Cage2+									
No	84.21	85.13	85.26	90.83	87.72	84.70	91.48	91.20	90.20
Yes	15.79	14.87	14.74	9.17	12.28	15.30	8.52	8.80	9.80
# missing	19	98	693	353	11	115	261	2630	4180
Weekly drinking									
None	42.70	47.57	42.51	49.90	35.29	38.92	53.08	46.28	46.44
1-7	41.62	35.61	42.17	35.50	54.41	35.48	38.31	42.07	41.30
8-14	9.73	9.74	9.32	7.87	7.35	15.72	5.83	7.64	7.94
15+	5.95	7.09	6.00	3.73	2.94	9.86	2.79	4.00	4.32
# missing	5	11	59	37	0	9	32	333	486
Smoking									
Never smoked	42.33	45.74	53.18	50.29	66.18	50.59	60.56	59.92	57.83
Former	14.29	12.91	12.67	16.68	13.24	12.61	12.61	14.89	14.45
Current	43.39	41.35	34.56	33.03	20.59	36.80	26.83	25.19	27.72
# missing	1	2	20	16	0	3	9	101	152
Speeding									
Within 5 mph	64.52	52.68	52.92	58.58	51.47	50.92	55.44	55.74	55.74
>5-10 mph	22.58	27.93	36.92	32.42	35.29	35.14	33.54	34.37	34.37
>10 mph	8.60	7.40	6.27	4.96	5.88	6.46	5.60	5.85	5.85
Don’t drive	4.30	12.01	3.88	4.04	7.35	8.26	5.42	3.57	4.04
# missing	4	14	69	35	0	11	29	365	527
Seatbelt use									
100%	13.51	15.94	15.52	11.08	16.92	22.52	13.02	9.81	11.25
51-99%	18.38	25.31	27.23	21.40	30.77	30.78	21.61	20.86	22.03
<51%	68.11	58.74	57.26	67.52	52.31	46.70	65.37	69.33	66.72

# missing	5	15	78	43	3	11	34	374	563
Drinking and diving									
No	89.30	87.79	87.51	92.05	88.24	81.31	91.16	91.03	90.42
Once	3.21	4.85	5.16	3.73	5.88	5.52	3.69	3.96	4.12
>2	7.49	7.35	73.3	4.21	5.88	13.13	5.15	5.01	5.45
# missing	3	9	66	39	0	7	22	283	429
Frequent loss									
Seldom/never	67.02	61.41	70.55	69.14	76.12	73.07	71.03	76.83	74.88
Often/sometimes	32.98	38.59	29.45	30.86	23.88	26.93	28.97	23.17	25.42
# missing	2	7	24	17	1	5	12	151	219
Consider hurting self									
Seldom/never	97.33	86.15	96.15	96.87	95.59	93.13	96.79	97.82	97.20
Often/sometimes	2.67	13.85	3.85	3.13	4.41	3.87	3.21	1.82	2.80
# missing	3	8	26	23	0	5	16	182	262
Depressed									
Seldom/never	87.23	71.27	84.69	86.51	88.24	84.95	85.18	89.59	87.94
Often/sometimes	12.77	28.73	15.31	13.49	11.76	15.05	14.82	10.41	12.06
# missing	2	6	35	24	0	6	20	198	291
Worries									
Seldom/never	86.17	69.21	79.84	80.85	73.13	80.65	78.91	85.55	83.54
Often/sometimes	13.83	30.79	20.16	19.15	26.87	19.35	21.09	14.45	16.45
# missing	2	9	39	24	1	5	10	227	317
Life satisfaction									
Mostly/totally	76.47	62.66	69.61	72.13	69.12	70.64	71.24	77.10	74.91
Not/somewhat	23.53	37.34	30.39	27.83	30.88	29.36	28.76	22.90	25.09
# missing	2	7	28	20	0	6	17	180	262
Suicidal thoughts									
No	92.47	84.63	96.47	97.17	98.53	96.28	97.12	98.02	97.37
Yes	7.63	15.37	3.53	2.83	1.47	3.72	2.88	1.98	2.63
# missing	4	8	29	22	0	5	13	188	269
Family problems									
Seldom/never	75.00	67.08	71.29	70.58	77.94	81.78	66.31	82.33	78.47
Often/sometimes	25.00	32.92	28.71	29.42	22.06	18.22	33.69	17.67	21.53
# missing	2	10	31	26	0	13	17	224	323
Support									

Sometimes/always	88.11	80.20	87.43	86.58	95.59	86.34	88.57	90.42	89.30
Never/hardly ever	11.89	19.80	12.57	13.86	4.41	13.66	11.43	9.58	10.70
3 missing	5	18	78	44	0	18	40	398	601
Work stress									
Seldom/never	70.05	65.18	68.87	70.80	64.62	73.42	70.38	70.90	70.51
Often/sometimes	29.95	34.82	31.13	29.20	35.38	26.58	29.62	29.10	29.49
# missing	3	12	87	58	3	11	29	417	620
Job satisfaction									
Mostly/totally	28.11	37.01	34.28	30.89	37.31	32.58	31.79	27.34	29.13
Not/somewhat	48.11	40.40	42.82	45.95	46.27	44.65	43.80	53.66	50.49
Not applicable	23.78	22.60	22.90	23.16	16.42	22.78	24.41	19.01	20.38
# missing	5	22	93	48	1	14	52	441	677
Muscle exercise									
Rarely	85.03	72.04	76.98	77.15	72.06	76.89	73.57	77.92	77.31
1-2 week	13.37	22.59	19.99	19.52	23.53	20.59	22.65	19.12	19.60
3+ week	1.60	5.37	3.03	3.33	4.41	2.52	3.78	2.96	3.09
# missing	3	4	34	18	0	2	9	209	279
Aerobic exercise									
Rarely	68.45	58.23	59.96	61.77	56.72	60.68	56.66	65.77	63.80
1-2 week	25.67	31.81	30.14	28.47	31.34	30.86	31.70	27.31	28.24
3+ week	5.88	9.96	9.90	9.76	11.94	8.46	11.64	6.92	7.96
# missing	3	7	29	19	1	3	13	181	279

*Individuals with only one outcome are counted for each event.

Table 4 Odds ratios (CI) for 7 outcomes on demographic, prior hospitalization and HRA. (n=37,496).

	Injury to Self = N = 920		Injury to others N = 7716		Victim Intentional Injury N = 3505		
Risk factors	Suicide	Suicide Attempt	Spouse Abuse Perpetrator	Child Abuse Perpetrator	Homicide	Assault Hospital	Spouse Abuse Victim
	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Gender							
Women	1.00	1.00	1.00			1.00	1.00
Men	6.78*(2.98-14.3)	0.74*(0.61-0.90)	7.01 (5.78-8.50)			5.63*(3.68-8.62)	0.30*(0.27-0.33)
Age							
<21			2.67*(1.90-3.74)	1.22 (0.86-1.73)			2.39*(1.65-3.50)
21-25			3.42*(2.60-4.51)	2.06*(1.62-2.61)			2.84*(2.08-3.89)
24-30			2.56*(1.98-3.20)	2..07*(1.67-2.55)			2.28*(1.71-3.07)
31-35			1.87* (1.48-2.36)	1.71*(1.41-2.09)			1.94*(1.48-2.55)
36-40			1.42+(1.12-1.79)	1.54*(1.27-1.88)			1.48*(1.12-1.95)
>40			1.00	1.00			1.00
Race/Ethnicity							
White		1.00	1.00	1.00	1.00	1.00	1.00
Black		0.76*(0.62-0.93)	2.84*(2.60-3.11)	1.43*(1.31-1.57)	2.55*(1.59-4.21)	1.53*(1.27-0.93)	2.11*(1.91-2.33)
Hispanic			1.60*(1.35-1.89)				1.46*(1.96-1.77)
Native American/Alaskan			1.70+(1.11-2.60)				1.71*(1.04-2.80)
Asian/Pac Islander			1.26 (0.92-1.72)				1.40+(1.01-1.94)
Other			1.63*(1.31-2.03)				1.34 (0.69-1.03)
Education							
High School (equiv) or less			1.00	1.00		1.00	1.00
Some college			0.96 (0.80-1.15)	0.94 (0.79-1.11)		0.86 (0.53-1.40)	0.84 (0.69-1.03)
College or greater			0.60*(0.46-0.78)	0.64*(0.50-0.81)		0.32*(0.17-0.63)	0.63*(0.48-0.83)

Rank							
E1-E4		1.00	1.00	1.00	1.00	1.00	1.00
E5-E6		0.64*(0.48-0.86)	0.74*(0.69-0.84)	0.66*(0.59-0.75)	0.64 (0.37-1.09)	0.28*(0.23-0.34)	0.82*(0.71-0.94)
E7-E9		0.32*(0.19-0.54)	0.51*(0.42-0.63)	0.43*(0.35-0.51)	0.64 (0.32-1.28)	0.12*(0.08-0.18)	0.64*(0.50-0.81)
Officer/Warrant		0.24*(0.16-0.38)	0.20*(0.15-0.28)	0.26*(0.19-0.35)	0.11*(0.03-0.46)	0.38*(0.20-0.74)	0.30*(0.21-0.43)
Time in active Service							
<2		4.75*(3.08-7.32)	1.44*(1.14-1.81)				2.07*(1.60-2.68)
2-5		1.85*(1.25-2.78)	1.30*(1.07-1.57)				1.74*(1.40-2.15)
>5-10		1.54*(1.12-2.13)	1.27*(1.10-1.47)				1.51*(1.28-1.79)
>10 years		1.00	1.00	1.00			1.00
Marital Status							
Single		1.00	1.00	1.00			1.00
Married		0.72*(0.56-0.90)	3.66*(3.24-4.13)	1.51*(1.29-1.77)			5.54*(4.77-6.43)
Divorced/Widowed/ Separated		0.70 (0.45-1.04)	1.56*(1.18-2.04)	2.50*(2.01-3.11)			1.56*(1.16-2.50)
Dependents							
Member or spouse	1.00	1.00	1.00	1.00			1.00
3	0.54*(0.33-0.85)	1.46*(1.07-1.94)	1.32*(1.17-1.47)	2.62*(2.27-3.03)			1.26*(1.11-1.43)
4	0.45*(0.28-0.72)	1.44*(1.04-1.98)	1.33*(1.17-1.51)	4.29*(3.71-4.96)			1.55*(1.36-1.78)
5 or more	0.62+(0.38-1.00)	1.85*(1.27-2.69)	1.95*(1.69-2.24)	7.95*(6.81-9.27)			1.78*(1.51-2.12)
Hazardous Duty Pay 1 year prior event							
None (past year)	1.00	1.00	1.00	1.00		1.00	1.00
Parachute and other	0.68*(0.56-0.82)	0.67*(0.50-0.91)	0.86*(0.76-0.98)	0.75*(0.64-0.87)		1.69*(1.37-2.08)	
Other hazard pay	0.45*(0.29-0.71)	0.71 (0.38-1.31)	0.78+(0.60-1.00)	0.74*(0.56-0.98)		0.71 (0.40-1.25)	

Hospital 1 year prior to event							
Alcohol							
No	1.00	1.00	1.00	1.00		1.00	1.00
Yes	2.47*(1.16-5.26)	2.56*(1.71-4.11)	2.16*(1.59-2.93)	1.99*(1.44-2.77)		2.87+(1.03-3.37)	1.74*(1.61-2.05)
Mental Health							
No	1.00	1.00	1.00			1.00	
Yes	4.69*(2537-8.70)	7.54*(5.59-9.17)	2.32*(1.79-3.02)			1.84+(1.07-3.17)	
Injury							
No	1.00	1.00	1.00		1.00	1.00	
Yes	2.04*(1.29-3.23)	1.97*(1.46-2.67)	1.18+(1.01-1.37)		2.43*(1.15-5.12)	1.90*(1.43-2.52)	
Cage2+							
No			1.00				
Yes			1.14+(1.01-1.29)				
Weekly drinking							
None			1.00	1.00	1.00	1.00	
1-7			1.06 (0.97-1.16)	0.84*(0.76-0.92)	1.54 (0.58-4.08)	1.03 (0.85-1.24)	
8-14			1.26*(1.10-1.46)	1.01 (0.85-1.19)	1.10 (0.26-4.68)	1.88*(1.46-2.43)	
15+			1.16 (0.97-1.38)	0.77+(0.61-0.97)	2.43*(1.51-5.12)	1.60*(1.17-2.20)	
Smoking							
Never smoked	1.00	1.00	1.00	1.00		1.00	
Former	1.54 (0.98-2.41)	1.29+(1.00-1.66)	1.00 (0.89-1.13)	1.28*(1.13-1.45)		1.03 (0.80-1.33)	
Current	2.56*(1.62-3.14)	1.44*(1.20-1.73)	1.31*(1.19-1.43)	1.27*(1.14-1.41)		1.23*(1.02-1.48	
Seatbelt use							
100%			1.00			1.00	1.00
51-99%			1.16*(1.06-1.27)			1.37*(1.14-1.66)	0.99 (0.99-1.11)
<51%			1.23*(1.09-1.38)			1.65*(1.33-2.05)	1.25*(1.08-1.43)
Drinking and diving						1.00	
No						1.11 (0.78-1.58)	
Once						1.41**1.09-1.83)	
>2							

Consider hurting self							
Seldom/never		1.00					
Often/sometimes		1.66*(1.17-2.26)					
Depressed							
Seldom/never		1.00					
Often/sometimes		1.39*(1.11-1.75)					
Suicidal thoughts							
No	1.00	1.00					
Yes	2.93*(1.64-5.23)	2.28*(1.71-3.12)					
Family problems							
Seldom/never		1.00	1.00	1.00			1.00
Often/sometimes		1.43*(1.18-1.73)	1.63*(1.49-1.78)	1.49*(1.35-1.65)			1.86*(1.68-2.05)
Support							
Sometimes/always				1.00			
Never/hardly ever				1.33*(1.17-1.52)			
Work stress							
Seldom/never						1.00	1.00
Often/sometimes						0.78*(0.65-0.94)	0.90+(0.82-0.99)
Aerobic exercise							
Rarely							1.00
1-2 week							0.87 (0.74-1.02)
3+ week							0.82*(0.70-0.96)
Months between HRA & event							
		1.00*(1.00-1.00)	1.00*(1.00-1.00)	1.00*(1.00-1.00)			

* $p < .01$ +$p < .05$.

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APPENDIX B – CONFERENCE ABSTRACTS

Benjamin K, Hollander I, Toboni H & Bell N. Measuring hospital episodes of care for use in alcohol and injury epidemiological studies. *Department of Defense, Peer Reviewed Medical Research Program (PRMRP) Investigators Meeting*. Puerto Rico: April 26-28, 2004.

Hollander IE & Bell NS. Army Substance Abuse Program: A look at soldiers referred and enrolled for alcohol abuse. *American Public Health Association. 134th Annual Meeting: Public Health and Human Rights*. Boston: November 4-8, 2006.

Measuring hospital episodes of are for use in alcohol and injury epidemiologic studies

Authors: Katy Benjamin Ph.D., Ilyssa Hollander M.P.H., Holly Toboni M.A.* & Nicole Bell Sc.D.
Social Sectors Development Strategies, Inc. & *Geo-Centers, Inc.

BACKGROUND/PURPOSE: Hospital administrative data are frequently used to estimate the incidence and prevalence of disease within a community. A major limitation of this data for epidemiologic purposes is that cases cannot be linked at the individual level. Counts of events represent hospitalizations, not patients. Thus, readmissions and transfers cannot be accounted for, resulting in inflated disease estimates from "double counting" patients who are hospitalized more than once to continue care for the same condition within the study period. Various indirect methods for identifying multiple hospitalizations that constitute a single episode of care have been employed, but are not generally empirically derived. This study uses linked data in order to derive empirically-derived estimates of hospitalizations for injury- or alcohol-related conditions in active duty Army personnel and to quantify the extent of overcounting that would occur if transfers are not properly identified. **METHODS**: Data was obtained from the Total Army Injury and Health Outcomes Database (TAIHOD) for the years 1990-2000. Using complete transfer codes from hospitalization records, we identified all Army soldiers transferred between hospitals within a 60 day period for both alcohol or injury conditions. Half of these known transfers were used to construct an algorithm for identifying transfer cases when such codes were missing or ambiguous. The algorithm was validated on the other half of known transfers. The distribution of time between hospitalizations ("lag time") was analyzed for each condition as well as for diagnostic sub-groups. The resultant episode of care algorithm was applied to identify probable transfers among those with > 1 contiguous injury- or alcohol-related hospitalization whose records contained no or incomplete information on transfer status. **RESULTS**: There were 83,713 hospitalization records with an injury diagnosis and 30,365 hospitalization records with an alcohol-related diagnosis between 1990-2000. After accounting for known transfer cases, 1,516 alcohol-related hospitalizations and 2,141 injury hospitalizations were identified as transfers, and did not constitute discrete episodes of care. Most (39%) were transferred within 24 hours. Among those hospitalized for alcohol abuse, 93% were transferred within 3 days of discharge from the initial hospitalization; over 98% were transferred within 4 days. Lag times for alcohol abuse transfers ranged from 0 – 43 days, with a mean lag time of 1.5 days (SD = 2.3 days). Among injury cases, 89% were transferred within 3 days and 97% within 10 days of discharge from the initial hospitalization. Lag times for injury hospitalizations ranged from 0 - 54 days, with a mean lag time of 1.6 days (SD = 3.6 days). More severe types of injuries such as burns and head injuries had shorter mean lag times than injuries such as sprains or strains. Supporting text analysis revealed that longer lag times were more common when patients were transferred to a CONUS hospital from overseas. **CONCLUSION**: In this population of active-duty Army personnel, estimating injury or alcohol abuse incidence without taking transfers into account would result in an overcount of approximately 6%. Investigators need to account for transfers when using hospital data to estimate disease incidence.

NOTE: The abstract in the Proceedings has been revised based upon additional analyses.

The Army Substance Abuse Program: A look at soldiers referred and enrolled for alcohol abuse.

Ilyssa Hollander, Nicole Bell

Abstract:

The U.S. Army Substance Abuse Program (ASAP) provides evaluation and treatment services for drug and alcohol abusers within the Armed Forces. ASAP is designed to identify and treat soldiers who have a potential for recovery, and therefore the ability to further contribute to the military. From 1988 to 2003 there were 188,139 Army soldiers referred to ASAP for an evaluation. Most soldiers were referred by a Commander (30%), after an investigation (23%), or through self referrals (19%). Once referred for an evaluation, soldiers might be enrolled in the Army's alcohol treatment program. Of those initially referred for evaluation, 57% (N=107,752) were enrolled. Sixty-seven% of non-enrolled soldiers attended a mandatory 12 hours training program (ADAPT) instead. An additional 19% of those nonenrolled were found to have no alcohol problem after interview with an intake counselor. The objectives of this ongoing study include linking data from the ASAP to the Total Army Injury and Health Outcomes Database (TAIHOD) which include health and personnel records in order to explore and describe the demographics characteristics of soldiers referred to ASAP by referral mechanism as well as those enrolled and treated within ASAP. Ultimately this work will allow us to identify demographic subgroups at particular risk for program failure or relapse. Results will also help identify where the ASAP program can improve screening and treatment of soldier in order to improve these services so that soldiers can achieve optimal health and functioning levels both during and after military service.

Learning Objectives:

At the conclusion of the session, the participant (learner) in this session will be able to:

1. Describe the demographic characteristics of soldiers referred to the Army Substance Abuse Program as well as those ultimately enrolled in the program.
2. Describe the mechanisms for referral to the Army Substance Abuse Program and variations in enrollment patterns based on referral mechanism as well as demographic patterns.
3. Identify demographic and occupational subgroups of the Army who may require more effective preventative and therapeutic measures.